REPORT OF PROCEEDINGS

Second Conference on Maple Products

November 16-18, 1953

Eastern Utilization Research Branch
Agricultural Research Service
U. S. Department of Agriculture
Philadelphia 18, Pennsylvania

Conference was held at the Eastern Regional Research Laboratory with representatives from the United States and Canada participating. The Extension Service, Agricultural Experiment Stations, universities, maple producers, processors and distributors, the United States military services and the United States Department of Agriculture were represented.

This report summarizes the discussions of the various speakers during the conference. If further details regarding any particular subject are desired, they may be obtained by writing to the person concerned. See the appended list for names and addresses.

PROGRAM

Monday, November 16

9:45 a.m.

Welcome and Objectives of the Conference	P. A. Wells, Director Eastern Regional Research Laboratory

9:55 a.m.

What Extension is Doing to Put Research into Practice	P. V. Kepner, Assistant Director Extension Service Washington, D. C.

REGULATORY PROBLEMS

10:15 a.m.

Present Status of Standards for Grades of Maple Sirup	Elmer P. Bostwick Fruit and Vegetable Branch PMA, Washington, D. C.

10:35 a.m.

Discussion, led by	Horace V. Shute, Director Division of Markets Department of Agriculture Montpelier, Vermont

INDUSTRIAL TRENDS

11:15 a.m.

Future of Straight Maple and Blended Maple Sirups	Hugh R. Conklin, Head Marketing Activities General Foods Corporation Hoboken, New Jersey

11:45 a.m.

The Future of the Maple Industry in Minnesota and Wisconsin	Sherman A. Holbert President, Holbert Bros. Onamia, Minnesota

12:30 p.m. LUNCH

2:00 p.m.

A Balance Sheet of the Maple Industry	Frank Rees, Secretary Pure Maple Syrup & Sugar Packers Association Essex Junction, Vermont

Monday, November 16 (continued)

2:30 p.m.

The Roadside Stand and Maple Festivals as Retail Outlets for Maple Products — Ture L. Johnson, Farm Forester, Ohio Dept. of Natural Resources, Division of Forestry, Burton, Ohio

3:00 p.m.

What Associations Have Done and Can Do for New York Maple Producers — Fred Winch, Jr., Extension Forester, Cornell University, Ithaca, New York

3:45 p.m. ADJOURN

3:50 p.m. Taste Testing (Room 2006)

4:00 p.m. Meeting of Informal Maple Advisory Committee

Tuesday, November 17

8:45 a.m. Tour of the Laboratory

9:00 a.m. Taste Testing (Room 2006)

9:45 a.m.

Current Projects of the Vermont Sugar Makers Association — Clyde N. Smith, Manager, Vermont Sugar Makers Association, Burlington, Vermont

10:30 a.m.

Oil-Fired Evaporators: Do They Fill a Need in Sirup Production? — Chas. R. Hubbell, Maple Producer, Jefferson, New York

RESEARCH PROBLEMS

11:00 a.m.

A New Type of Sap Evaporator — R. K. Eskew, Eastern Regional Research Laboratory

11:40 a.m.

Some Changes that Sap Undergoes in a Continuous Atmospheric Evaporator — C. O. Willits, Eastern Regional Research Laboratory

12:30 p.m. LUNCH

Tuesday, November 17 (continued)

2:00 p.m.

A Report of Continuing Botanical Researches on Maple Sap at the University of Vermont — James W. Marvin, Chairman, Department of Botany, University of Vermont, Burlington, Vermont

2:45 p.m.

Factors Influencing the Production of High Quality Maple Sap. A Progress Report. — P. W. Robbins, Professor of Forestry, Michigan State College, East Lansing, Michigan

3:15 p.m.

Operation of an Experimental Sugar Bush — Fred Taylor, Professor of Botany, University of Vermont, Burlington, Vermont

3:45 p.m.

Influence of Tree Crowns on Sirup Production — Robert R. Morrow, Jr., Professor of Forestry, Cornell University, Ithaca, New York

4:15 p.m. ADJOURN

4:20 p.m. Taste Testing (Room 2006)

Wednesday, November 18

9:00 a.m. Taste Testing (Room 2006)

9:45 a.m.

Three Years of Propagation of Maple Stock by Vegetative Cuttings — S. J. Dunn, Plant Physiologist, University of New Hampshire, Durham, New Hampshire

10:15 a.m.

Current Canadian Maple Research Problems — Elphege Bois, Faculte des Sciences, Laval University, Quebec, Canada

Wednesday, November 18 (continued)

11:00 a.m.

Some Observations on the Nature of Color and Flavor of Maple Sirup	W. L. Porter Eastern Regional Research Laboratory

11:45 a.m. Taste Testing (Room 2006)

12:30 p.m. LUNCH

2:00 p.m.

The Organisms of Maple Sap: Their Effect and Control	J. Naghski Eastern Regional Research Laboratory

2:30 p.m.

Report of the Informal Maple Advisory Committee	Clyde N. Smith, Chairman (see page 2 for address)

2:55 p.m. Results of Taste Tests

WELCOME AND OBJECTIVES OF THE CONFERENCE

by

P. A. Wells, Eastern Regional Research Laboratory

Dr. Wells welcomed the delegates to the Laboratory. He pointed out that the meetings would be conducted on a strictly informal basis with ample time for full discussion of each paper. Attention was called to the first maple conference in November 1950, which was one of the most successful conferences ever held at the Laboratory. The present conference was expected to be larger than the one held in 1950.

A tour of the Laboratory has been arranged for Tuesday morning at 8:45 for those who care to make it, and cars will meet earlier trains on the Pennsylvania and Reading Railroads that morning for the convenience of those making the tour.

A report of the conference containing summaries of the papers and discussions will be prepared, and a copy will be sent to each delegate attending. Extra copies will be supplied on request.

At the request of Dr. Wells each delegate stood and introduced himself.

WHAT EXTENSION IS DOING TO PUT RESEARCH INTO PRACTICE

by

P. V. Kepner, Extension Service
U. S. Department of Agriculture, Washington, D. C.

(Presented by W. K. Williams, Extension Service, U.S.D.A., Washington, D. C.)

I appreciate the opportunity to meet with you here today and to outline broadly the role of the Cooperative Extension Service in putting research into practice on American farms. We in Extension Service are keenly aware of the many programs needed in the development of a better agriculture and the great need for research as it applies to farm and home problems. In practically all fields of agriculture, Extension assistance is needed in bridging the gap between research and farm practice. While there is not the urgency in forestry as in some of the perishable crops, it is recognized that there is serious need for research information in this field and in products of the forest. Though progress has been made in applying forestry and forest products research, considerably more progress is needed in connection with technical practices, economic production of forest crops, and the fullest use of them in a balanced farm management program.

One of the strong points of the American way of life is our desire to bring together the best thinking of all groups interested in a particular program, in order that greater accomplishments may be achieved. This is exemplified by the splendid work of the Eastern Research Laboratory in bringing together Government agencies, both Federal and State, industry, and other private groups and organizations, for an exchange of ideas. This helps to unify thinking and develops teamwork in the solutions of particular problems. While acting individually these agencies can, of course, and do accomplish a great deal, yet by working together on common problems and toward common objectives they

achieve an effort which is greater than the sum of their individual accomplishments. No one with knowledge of the problems involved in maple production expects easy victories in the drive for economic production of better quality maple products. Certainly there is nobody more aware of this than research people, foresters, and industry working on these problems. As we look at maple progress, there is well-earned praise for the splendid work of many groups in reducing contamination, in producing better grades, and in the better marketing of maple products in the relatively few years that this work has been given attention. It is in meetings like this and the one held here in 1950 by the Eastern Regional Research Laboratory that real headway is being made toward solving some of the difficult problems in the production, processing, and marketing of maple products.

The Cooperative Extension Service is well aware of the heavy educational responsibility it has in this and numerous other programs. Educational work in forestry is confronted with difficulties due to the longer period involved in growing a crop ready for harvest. In the field of maple production, if the trees have reached tappable sizes, the problem is somewhat easier. However, there is plenty to think about in proper management, i.e., protection of the stand, continuous production of maple products as compared with liquidation, labor and equipment problems for maple production, the application of technical practices which must be simple and thoroughly understood, and fitting maple work into the farming program. You can better understand the difficulties from an extension point of view when we consider the thousands of farmers to be reached throughout the maple region. If continued progress is to be made in maple production, I am sure we can agree that sustained research and educational work are imperative.

As the educational arm of the Department of Agriculture and of the land-grant colleges, the Cooperative Extension Service is giving educational backing to Department programs and farm problems. The purpose is to bring to farm people the knowledge and assistance needed, to increase efficiency and income, and to help them find satisfaction and growth in rural life for themselves and their communities. Extension aims for wide participation of farm people in agricultural programs that encourage them to do things for themselves.

The local Extension representatives live and work with farm people in the counties. The county agricultural agent works with farmers and farm boys, the home demonstration agent works with farm women and farm girls, and, in some States, a 4-H Club agent works with both boys and girls. It is the business of these extension workers to help farm people with their individual and community problems, and to train, plan, and organize for a solution. They supply agricultural information based on the experiences of owners, research findings of State and Federal agencies, and assist in the application of improved practices through demonstrations and other educational means. In the conduct of this program wide use is made of the services and facilities available through the Department of Agriculture and the land-grant colleges.

The States have a group of extension specialists in agricultural and home economics at the land-grant colleges. The extension forester is one of this group who works with and through county agents in assisting farm woodland owners. I am happy to see there are several extension foresters here today. Coming from the field, so to speak, and with information on specific maple

problems, they will not only add something to the conference but will take away much information and feel strengthened in the knowledge of better maple production.

In reading a brochure issued by the New York State Maple Producers Association, I was interested in the statement that the high quality of sirup in that State was not gained the easy way, but that it came about through the efforts of the late Joshua Cope. It was he who initiated producers' meetings, wich promoted the exchange of ideas and taught the producers how to maintain healthy trees for better production. I believe also it was Cope who had a great deal to do with a maple-tapping machine and demonstrated its use. Such meetings for the discussion of woods management problems, practices, marketing trends, and demonstrations of equipment and improved sugaring practices, are two of the educational means used by extension agents to advance the maple program. Publications of various kinds, and circular letters, have had an important place in educational work. Field days and maple festivals as conducted in some States have attracted large crowds and have helped to acquaint consumers with maple sirup and helped to promote its use.

In Vermont, Extension Forester Foulds has conducted an active maple program following the usual extension pattern in working with producers. Prior to the maple season, Mr. Foulds met with a committee representing the Vermont Maple Producers Association, the State agriculture department, the State forest service, Agriculture Production and Marketing Administration, and the Extension Service. After considering the maple situation this group decided that a series of field days should be held in problem areas. These meetings were held in sugar bushes or at sugarhouses and were focused on the problems being faced by sugarmakers. Reports indicated that these meetings aroused considerable interest and were well received by producers. In addition, Mr. Foulds has assisted in conducting a maple industry improvement project or contest, sponsored by the Sugar Makers Association. Its purpose was the encouragement of improvement work in the sugar bush and in sugaring methods. Circular letters and other materials were used liberally in this educational venture. This contest feature has been discontinued, but the work goes on in some counties. Some agricultural agents feel that the best time to do extension work with sugarmakers is during the sugar season, in the sugarhouse, and in the sugar bush. Personal contacts would be made by a team of qualified advisers and suggestions would be made for improvements in woods and sugarhouse operations. Here is where use can be made of maple research information of the laboratory and State experiment stations. The exchange of ideas that comes out of contacts like these is always helpful. Fred Trenk, Wisconsin extension forester, and those in other States usually arrange a series of meetings each year among maple sirup producers to assist them with production and marketing problems and keep them informed on new practices and equipment. I am sure that the foresters here today can give us some interesting details of how this work is carried on and the results as indicated by better sugarmaking practices.

Before leaving Washington, I had occasion to glance over some maple production figures from the Bureau of Agricultural Economics which show for the period 1920 to 1925 there was an average production of better than 3 million gallons as compared with an estimated production of sirup for the United States in 1953 (a bad year) of 1,247,000 gallons, a decrease of 25 percent from the 1,654,000 gallons produced in 1952. This downward trend is also shown in the

trees tapped, which during the period 1920 to 1925 averaged better than 14 million trees yearly as compared with 7 million in 1952 and 6½ million in 1953.

Incidentally, the Forest Service reports that this downward trend also shows up in maple lumber; for example, in Vermont the maple lumber production is currently averaging about 20 million board feet as compared with 45 million for the period 1910 to 1915. This is also true of the United States maple production, which is now roughly half of that of 1910. I do not wish to comment on these figures, which obviously raise some serious questions if we are thinking in terms of a continuing industry. As I see it this is a very challenging situation which will require the best thinking of research, maple producers, processors, and foresters.

I am pleased that extension foresters, county agents, and to some extent home demonstration agents have shown an active interest in maple problems from the production in the woods, at sugarhouses, and on to consumers.

It is believed that there is a real opportunity for extension workers to give further support and perhaps in some States rather intensive effort in disseminating among producers reliable information on economic and technical aspects of maple production. Perhaps there is need in heavier-producing counties for building effective committees of local leaders to spur the work at the grass-roots. Getting pertinent information into the local press, local radio and television programs, and into all the various channels of communication is always desirable. Motion pictures on maple have been used successfully in some States.

With the enthusiastic teamwork of all groups concerned with maple, the ultimate success of efforts to maintain production of better quality sirup seems assured.

The Eastern Regional Research Laboratory is making a splendid contribution to the welfare of the maple industry by its research and by its interest in exchanging views on problems and what to do about them as we are doing here today. Some of you are no doubt pioneers in the field of improved maple production practices. The public-spirited assistance on your part and that of many hundreds of State and local leaders would indicate that interest is high and should attain desirable objectives.

In closing I want to assure each of you that the Cooperative Extension Service, within its available resources, will be very happy to continue to cooperate with the groups represented here in conducting educational programs that may be needed in the field of maple production.

Discussion

It was conceded that the ideal time to hold meetings of producers is during sirup making time, at the sugar bushes. However, in most places it is next to impossible to get producers to leave their work for this purpose. The sap season is too short. In Michigan a TV show was used to attract public attention to maple products.

Extension folks not only work hard themselves, but they work others even harder in getting programs together. This was offered as a sincere tribute to the Extension Service.

PRESENT STATUS OF STANDARDS FOR GRADES OF MAPLE SIRUP

by
Elmer P. Bostwick, Production and Marketing Administration
U. S. Department of Agriculture, Washington, D. C.

A proposed revision of U. S. Standards for Grades of Maple Sirup was first submitted to the industry at the conference on maple products held here in November of 1950. The proposal suggested certain changes in the grade standards for maple sirup which were issued in 1940 and which have been in effect since then. These changes were designed to bring the standards into line with other United States Standards for grades of processed products which have been issued by the Department. The grade standards of the Department are national in scope and, insofar as possible, reflect the practices and experiences of an entire industry, including any segments which may contribute to the production or the utilization of the product. In general, if a standard of quality is to be of use to all areas it must reflect the most widespread and acceptable qualities of the product that is available on a national scale. In the proposed revision of the standards for grades of maple sirup, the quality of the product was based on the factors of flavor, absence of defects, and clarity. The percentage of soluble solids and the equivalent specific gravity and percentage of moisture were specified and a provision requiring not less than 65 percent of soluble solids for each grade was included. This requirement would be determined by means of a refractometer. The percentage of soluble solids and equivalent values could also be determined by any other method giving equivalent results. Color was not considered a factor of quality and in this respect the revised standards differ from the 1940 grade standards. However, provision was made for the classification of color by means of the U.S.D.A. permanent glass color standards for maple sirup which were developed in cooperation with the Eastern Regional Research Laboratory and announced by the Department in February of 1950.

In defining the factor of flavor, the proposal provided that the product have a good characteristic flavor and be free from objectionable flavors such as those caused by scorching or by "buddy" or fermented sirup, or any foreign or disagreeable flavor.

Under the factor of absence of defects, the cleanliness of the sirup was stressed and the required degree of freedom from extraneous material, such as pieces of bark, soot, or particles of earthy material or other defects which might be in suspension or deposited as sediment in the container, was established for each grade.

The third factor of quality--clarity--had reference to the degree of freedom from fine particles of mineral matter in suspension, such as malate of lime, "sugar sand," or "niter," which cause a cloudiness in the product and detract from its appearance.

These factors were substantially the same as those contained in the standards issued in 1940. The changes made were principally in the method of presenting the factors and in the assigning of weighted score points to them. These provisions simplified the evaluation of the quality factors in establishing the grade of the product.

In view of the widely differing preferences expressed by interested persons from the different areas as to the most acceptable flavor of maple sirup, there was considerable discussion as to whether this factor could be uniformly evaluated by subjective methods in grading the product. Differences of opinion also extended to the color of maple sirup, some expressing a preference for a light-colored product, whereas others preferred a deeper-colored sirup. It has been pointed out that the mild maple flavor is preferred in some areas, as contrasted with a preference for a more pronounced maple flavor in other areas.

An indication of flavor and color acceptable to consumers in general may be evidenced by the demand for sugar and maple blends. These products are marketed at prices comparable to those of competing food items and this outlet provides a stable and large market for maple products. On the basis of 1951 statistics it is estimated that more than 80 million pounds of maple blends were produced, as compared with 13.9 million pounds of pure sirup entering domestic consumer channels.

In regard to color, it is our observation that maple blends, as well as pure maple sirup marketed nationally in retail channels, appear to be standardized in either the medium amber or dark amber color range. These colors appear to have been accepted generally by consumers as representing good quality. It also appears that a medium amber or dark amber sirup with a pronounced maple flavor is acceptable to most consumers.

After the discussion on the grade standards for maple sirup at the conference on maple products in 1950, correspondence was exchanged and meetings were held with industry representatives in producing areas. Considerable opposition developed to eliminating color as a quality factor, and when the proposed revision of the U. S. Standards for maple sirup was published in the Federal Register under rule making procedure, color was retained as a quality requirement in establishing the grade of the product. However, provision was made for more latitude in color in qualifying for U. S. Grade A or U. S. Fancy maple sirup. Under this classification, maple sirup with a pronounced maple flavor would be eligible for grading as U. S. Fancy maple sirup.

In conformity with the Department's policy of simplification of grade designations the proposed revision provided for grade nomenclature which was similar to that for other United States Standards for processed products developed over the past 20 years. These grade designations are well known to producers, packers, buyers, distributors, and consumers. Competing products, such as sugarcane sirup, honey, preserves or jams, and other spreads are nationally known to consumers by these designations. In all these standards, Grade A and Fancy are synonymous terms of quality and are so recognized by consumers generally. It was our feeling that standardized nomenclature, nationally understood, would be helpful in the overall marketing program for maple sirup.

In order that all interested persons would have equal opportunity to present their views on the proposed revision, copies were circulated to all producing areas through the State departments of agriculture or State colleges. Meetings, when requested, were arranged and every effort was made to acquaint all interested persons with the requirements of the proposed revision of the standards. Correspondence and comments received by the Department clearly

indicated that a wide difference of views existed with respect to the provisions outlined in the standards. It appears that a closer agreement of views within the industry must develop before national grade standards, acceptable to all producing areas, could be developed. The Department does not have plans for any further action in connection with the maple products standards, unless direct requests for further study are received from the industry.

Before closing, I should like to point out that national grade standards issued by the Department of Agriculture are designed to serve as a guide to packing a good quality product, and as an aid to buyers and sellers; they may be of assistance in financing, and they may be used for inspection on a common basis of trade for all areas and all markets. The grade standards of the Department for maple sirup are for permissive use and do not imply any labeling requirements whatsoever. There are no Federal regulations that require maple sirup to be labeled with respect to quality.

The Federal Food and Drug Administration of the Department of Health, Education and Welfare is responsible for seeing that processed foods which move in interstate commerce are correctly labeled. If the maple sirup, for example, were labeled in terms of the United States Standards, the sirup would be expected to meet the specifications of that particular grade as outlined in the United States Standards for grades.

It has been our observation that when a U. S. Standard is developed to serve an industry on a national basis, such a standard is sound and practical and is a safe basis for marketing transactions and for determining loan values on processed food products.

Discussion

Question: Who proposed the change in standards in 1950?

Answer: The change came as a natural development in the growth of standards and of the policies of the P.M.A. and U.S.D.A. on improving standards for federal grades on all commodities. With the announcement of the permanent glass standards in February, 1950 it seemed to be the appropriate time for considering a revision of the 1940 standards.

Question: Since these revised standards are not in effect, what grade standards can be used?

Answer: The 1940 standards are still in effect.

Question: What is the basis for grading Canadian sirup?

Answer: The Province of Quebec uses caramel glycerin color standards. The percent transmission at 560 mμ of a layer 19 mm. deep for the four grades is as follows: Fancy - 70%; clear or A - 50%; amber - 30%; and dark - 15%.

Question: Which states prefer to use light color as indication of better grade in maple sirup?

Comments from the producers present from the various states indicated that Vermont, New Hampshire, New York and Michigan prefer a lighter sirup. Wisconsin and Minnesota favor the darker grades. However, Wisconsin would like to have flavor considered a part of the grade because there are dark sirups with good flavor even though much of the dark sirup has poor flavor. The American Tobacco Company is greatly interested in grading by color and has specified color in its purchases as far back as 1920, but believes that aroma should also be considered.

Question: Is the same trend toward the production of lighter sirups going on in Wisconsin as it is in New York?

Comment: Yes, and it is undoubtedly a reflection of the increased use of improved equipment and better "know how." The "know how" exercised by the producer influences the color to a great degree. The quality of maple sirup has steadily increased during the past 25 years and we like to think that this is largely due to the efforts and educational program of the extension service. There was a time even in the East when less than 15% of the crop consisted of No. 1 and Fancy, while at present there is only 15% in the darker grades. Production in the Eastern states is declining while that in Wisconsin is increasing. Producers must recognize the trends and adjust to them.

Question: What color standards were used prior to 1940?

Answer: At that time the standards were based on the work of Balch and of Bryan. The original range included 10 different dilutions of caramel. Of these three were chosen and adopted by the industry to delineate the three grades.

Question: How do you describe flavor and aroma standards?

Answer: It is difficult to define flavor, as it is subject to individual interpretation. In other industries, as for example catsup, where flavor is highly important, consumer preference is used as a criterion. Any standards that are developed for maple would have to represent the opinion of the cross section of the country.

DISCUSSION OF STANDARDS FOR MAPLE SIRUP

led by

Horace V. Shute, Department of Agriculture, Montpelier, Vermont

Mr. Horace V. Shute, Director, Division of Markets, Department of Agriculture, Montpelier, Vermont, was not able to attend the meeting and lead the discussion on grading laws, and he sent a telegram to the conference expressing his regrets. Since it contained information of considerable interest to all maple producers, it is reprinted in its entirety, together with the discussion that followed its reading at the conference.

TELEGRAM

Montpelier, Vt., November 14, 1953
P. A. Wells, Director, Eastern Regional Research Laboratory
U. S. Dept. of Agriculture, Philadelphia, Pa.

"Please forward my regrets to group. Planned for months to attend but powers that be have stripped me of inspection and clerical help until this week had only 50% of help Dwinnell used to have so must stay put and hold pieces together. Am listing Vermont's latest contributions to maple which we secured in 53 state legislature as Clyde Smith might present them for me.

1. Power to embargo any lot of syrup to prevent disposal until analytical and legal machinery can act.

2. Authority to take direct action against adulteration instead of waiting on State Board of Health.

3. Authority to enforce grade marking regardless of destination of lot inspected, be it within or to an outside of the State destination.

4. Succeeded in standardizing container size for cold, hot, and very hot packing temperatures to save either thin syrup from spoiling or complaints from space unfilled packs.

Am urging state college and federal action on the following:

1. Determination of separate conductivity test minimums for each grade.

2. New analysis techniques to determine adulteration by phosphate type additives which now permit syrup which is blended to sell at half price and still satisfy lead number tests for purity.

3. To combine our efforts in preventing bootlegging of illegal syrup through the U. S. mails, in order to escape regular state inspection. This to be done by alerting Food and Drug, U.S.D.A. and state authorities in receiving state where syrup is being sent so that it may be apprehended.

4. Find a quantitative test to replace flavor tasting to determine lowest minimum to be allowed for Grade B syrup. Am anxious to hear of your group's accomplishment at the meeting."

H. V. Shute, Director
Division of Markets
Vermont Dept. of Agriculture
Montpelier, Vermont

Discussion

Comment: The actions taken by the state legislature with regard to regulatory measures in the industry are gratifying. We have previously seen items in transit that did not meet our standards and were outside our regulation. There has been a steady improvement in the quality

of maple sirups throughout all the producing areas and we like to believe that Vermont has been in front. The present demands for table sirup can use all of the good quality sirup produced. Color still is a good indication of the quality of maple sirup and we are trying to get a quality product established throughout the industry.

All will agree that in maple sirup flavor is the only ingredient of value, and we all know that in maple we have a variety of flavors. The clear-cut flavor of Fancy and No. 1 are different from the strong flavors of the darker grades. Although color may not be a critical factor yet it does give a good correlation with quality and grade, and the lighter grades of Vermont and New York sirups have met with consumer acceptance as quality products.

Under the previous laws in Vermont, the Public Health Department had charge of prosecution for adulteration. Under such circumstances it often happened that enough time would be lost between initial finding of suspected material by the Division of Markets and notification of the Board of Health that corroborative samples could not be obtained. Giving the Division of Markets equal rights for embargo and prosecution will make it easier to enforce the regulatory statutes.

Question: Is it difficult to enforce proper labeling or is there good producer cooperation?

Answer: Naturally there was a short period of time of non-cooperation when the regulation first went into effect. This had been taken care of by issuing warnings, and prosecution was not necessary. The clarity of the product has definitely improved and, furthermore, the customer is assured that the sirup is properly labeled and filtered.

Question: Is there a price differential for the different grades of sirup?

Answer: Yes, grade A usually commands a premium of $1 or more per gallon. It seems to be clear that we have two definite and distinct markets for sirup. One is the outlet for the better quality or so-called table sirup, and the other is the blending market, which absorbs the darker grades. Both of these are compatible with each other and it may be that sirup should be classified into either table grade or industrial grade, depending on the ultimate use.

Question: Would the use of debrowning reagents tend to complicate this problem of color, and should we not use flavor rather than color for grading?

Answer: When decolorizing agents are used to lighten the sirup there is an accompanying loss of flavor. The Vermont law definitely states that maple sirup cannot be bleached. Furthermore, the high standards for Vermont sirup based on light color should not be lowered in order to upgrade Western dark sirups. There also seems to be considerable contradiction among individuals who claim that

they prefer darker colored, strong flavored sirups, for invariably in their purchases they ask for first run sirup, which means a light-colored, good flavored product.

FUTURE OF STRAIGHT MAPLE AND BLENDED MAPLE SIRUPS

by

Hugh R. Conklin, General Foods Corporation, Hoboken, New Jersey

(Summary)

In our look at the future, we will take it in three parts:

a. What has happened to the straight maple and blended maple sirup industry in recent years, and where is it today?

b. Factors at work in the industry today.

c. Factors affecting the future of the industry.

Where Have We Been?

Compared with 1949 sales of straight and blended maple sirups, blended maple sales increased 5%, 12%, and 19% respectively in 1950, 1951, and 1952. During the same period, straight maple sales went up to 52% over 1949.

Why are sales of straight maple advancing faster than blends?

We believe that the tremendous sampling of maple-flavored sirup through the sale of blends has made millions of consumers aware of this highly desirable flavor. During recent years of improving economic conditions, many consumers have up-graded their purchases and at one time or another purchased some straight maple. It appears to be a factor both of promotion by blenders and of economic conditions. It is important to keep in mind that sales of straight maple through grocery stores represent only about 3-1/2% of the sales of blended sirups.

This is a rosy picture, but what about competition from other industries?

Our biggest competition is imitation maple sirup. During the four year period, 1949-1952, imitation sales to consumers increased 30% over 1949.

What is the importance of imitations to blends and straight maples? Blends and straight maples accounted for 65%, 64%, 62% and 64% of total "maple-flavored" sirup sold in 1949, 1950, 1951 and 1952, respectively. In the same years, imitations accounted for 35%, 36%, 38% and 36%. In spite of the tremendous growth of blends and straight maples, imitations continue to hold better than one-third of the "maple-flavored" market. In fact, they have slightly increased their share during the four-year period.

What is the reason for this? The low price of imitation in relationship to blends is the greatest factor for the strength of imitations. During the past

year, all blended maple sirups have averaged 27.5¢ on the grocers' shelves, while imitations have averaged 17.8¢ for a 12-ounce equivalent package. With the recent price increase of blends, due to the higher price of maple, we expect the 12-ounce equivalent price to advance about 1¢. The imitations' price ratio to blends will then drop from 65% to about 59% of the blend price. This, we feel, is of major concern to the industry.

There is, of course, additional competition in corn, cane, molasses, and sorghum sirups. While we have not measured these accurately, we estimate the volume of these sirups to be from three to four times as large as the business in maple and blended maple sirups. Competition is unlimited and poses a real challenge for the industry.

Factors at Work in the Industry Today

To show you what we consider pertinent factors, I want to quote from a recent consumer study made with a representative sampling of 3,000 housewives across the nation. Of primary concern is what kind of sirups they buy and use, and when and how they use it. The survey showed that 97% of all families use some kind of sirup. It also showed that 1% make all their requirements of sirup, 37% both make and buy their sirups, and only 59% supply their requirements exclusively from purchases. Our market, however, is 96% of all families.

What kind of sirup did they buy? The survey showed that 12% of all families purchased straight maple sirup, 15% imitation maple, 47% maple blends, 49% molasses, and 77% corn. This is not a key to volume, but merely indicates purchases once or more during the year of the sirup indicated. The fact that imitation maple sirup is sold in so much greater volume than straight maple sirup, yet the percentage of families using each is very similar, is an interesting fact. Again we relate this to the price situation.

When do they use sirup? In the winter the average family serves sirup 13.3 times per month and 9.9 times per month in the summer. Of the 13.3 times, 59% at breakfast, 18% at the evening meal, 13% at the noonday meal, and 10% between meals. Of the 9.9 times, 58% at breakfast, 17% in the evening, 13% at noon and 12% between meals. In summer there is a significant increase in the percentage of families using sirup between meals, which we think is a reflection of recent summertime promotions for the use of sirup on ice cream.

From this information, it is apparent that our opportunity for growth in the maple and blended maple sirup industry falls into three categories:

a. Converting non-users of straight or blended maple sirup to users.

b. Increasing the rate of use among users.

c. Creating and promoting new ideas.

How are we taking advantage of these opportunities?

Log Cabin sirup and other producers of sirups are advertising their products in use in tempting mouth-watering display advertising. This helps to convert non-users as well as helping to increase the rate of use of present users. A typical Log Cabin ad promotes pancakes, butter and Log Cabin sirup.

To increase the rate of present users, we currently are engaging in major promotional efforts to encourage consumers to serve the most popular dishes at times other than breakfast, primarily lunch and supper. A sample of an outstanding Log Cabin ad is a joint promotion of Log Cabin with Aunt Jemima Pancake Mix called the "All-American Meal". Possibly some of you saw this ad in the November 9 issue of Life Magazine or any one of several other publications.

Our efforts to promote new uses also fall into our planned program of developing what in the past has been contra-seasonal use of sirup. In 1950 Log Cabin started a summertime promotion on the "Golden Glory Sundae"--vanilla ice cream topped with you-know-what sirup. This promotion has been continued each year with full colored photographs of this eye- and taste-appealing sundae.

This proved to be reasonably successful, in that we picked up summertime business. Also, the fact that practically all other sirup packers got on the bandwagon and started promoting ice cream and sirup indicated that it was successful. This summer we broadened our consumer appeal into a major promotion called "Summer Treats with Log Cabin Sirup". This ad included color pictures of the "Log Cabin Snowball" (another sundae), "Log Cabin Whip", "Golden Glory Sundae", "Log Cabin Soda", "Maple-peach Sundae" and "Log Cabin Delight". In this ad the "Golden Glory Sundae" was the dominating feature, but there were several other tempting summertime dishes. Preliminary indications are that this was highly successful.

Factors Affecting the Future of the Industry

There are many factors which will affect the future of the maple industry. The six most important are:

a. The size of the maple crop and the availability of this product for either straight or blended sirups. This is so obvious it needs no explanation.

b. Technological improvements for the industry as a whole are of great importance. There have been no significant major technological improvements in the harvesting and processing of maple sirup in the past half century. This is practically the only agricultural commodity in which such a condition exists. There is a crying need for increased efficiency so the farmers can harvest a maple crop, sell it at a profit, and still not price the commodity out of existence.

   With the work now in progress in many places--such as that at the University of Vermont, here at Eastern Region Labs., and with various equipment manufacturers--there appears to be a good chance that improvements will be made to strengthen this industry.

c. The future of the industry will depend in great measure on general political and economic conditions. This implies a stable international situation and a continuance of prosperity. We believe that both of these conditions will prevail, although we probably will not continue to experience boom prosperity such as we have had in the past few years.

d. The price of maple and resulting price of sirup is a very important factor affecting the future of the industry. Undoubtedly the price of the product will depend in large measure on the three factors mentioned above. There are indications that, if the price of maple goes up further while other commodities, particularly cane and corn sugar, remain at their present levels, maple products can see a decline. If the price can remain stable or decrease, it will brighten the future.

e. Increasing population in the country is bringing two and one-half million new consumers into the market each year. Fortunately, sirup is the type of commodity which children start consuming at an early age and continue consuming through their lives. This increasing population can be a vital factor in the growth of the industry if marketing practices are geared accordingly.

f. A continuing growth for the industry is dependent upon an educational job which producers and packers of sirup are willing to do on consumers. There is a great competition from all sides for the consumer's dollar. It is important that the sirup industry continue to expound upon the benefits of maple and blended maple sirup, particularly considering the rapid growth of the country and the new consumers that need educating in this commodity each year. At the present time this educational job is being borne exclusively by the blenders.

With due consideration for all these factors, we hazard a guess for the future for the straight maple and blended sirup industry.

My own personal estimate, which is not to be construed as an estimate of the Management of Log Cabin sirup or of General Foods Corporation, is that by 1956 the total blend and straight maple consumer sales can be 25% higher than in 1952, which has been our peak year up to now.

THE FUTURE OF THE MAPLE INDUSTRY IN MINNESOTA AND WISCONSIN

by

Sherman A. Holbert, Holbert Brothers, Onamia, Minnesota

(Summary)

The history of maple in the Minnesota and Wisconsin area shows that it was produced very early in the days of the area's initial settlement both by the Indians and the settlers as a staple food item. The very earliest traders along the shores of Lake Michigan, and particularly in the Green Bay area, carried a great deal of maple sugar as a staple item of commerce.

After the farmers started to open the area they provided themselves with this sugar until about 1890, when white sugar became considerably cheaper, and the demand for maple lumber, which accompanied the great building program of that time, cut greatly into the major stands in the southeastern portion of Wisconsin, where a great deal of the industry was concentrated. In the 1920's and 1930's the industry dropped very greatly due to cutting in the areas of production and poor economic possibilities for its development. The failure

of the development of a reliable maple sirup market in the area also contributed.

The present era of development of maple in this area started at the end of World War II when the availability of more capital money in the forest areas permitted the establishment of a number of fine modern plants and the improvement and expansion of many small existing plants. Simultaneously, the Holbert firm developed an aggressive program for the sale of maple sirup manufacturing equipment and helped to establish a reliable market for the product. These facts resulted in a great increase in production and in the development of large and efficient plants that are beginning to set the pattern for the development of the maple industry in this Western area.

In connection with the development of large plants, I take this occasion to point out that there are tremendous tracts of undeveloped maple forests throughout northern Minnesota and some parts of Wisconsin which lend themselves to from 10,000 to 50,000 bucket operations and, in some instances, substantially larger if the efficiency of these large plants can be increased by better equipment. It is estimated that there are more tappable trees in this Western area that are untapped than there are tapped or tappable trees in the entire Northeastern maple area.

In connection with these possibilities for increased production, it is important to point out that the technological possibilities for greatly reducing the cost of handling sap in the field are either here or at hand. Since the end of World War II such things as the power driven tapping machine, flexible plastic buckets, the possible practical use of ultraviolet light for bacterial control, etc., have begun to have an effect on the industry. Ultimate extension of these possibilities, along with the use of flexible freeze-proof pumps and cheap plastic tubing, may reduce the cost of moving sap from the forest to the evaporator to a small percentage of the present cost. Use of improved evaporation methods, probably oil-fired, can again reduce the labor and, consequently, the over-all cost of making maple sirup. In addition to the mechanical improvements, a great deal of new information is at hand concerning the total productivity of the tree and methods of increasing over-all yields.

The above, coupled with the fact that the maple industry in the Minnesota-Wisconsin area is not encumbered with capital investments to any great extent, leads me to believe that the future for the producer in that area far exceeds the possibilities of any other region, and that the age of technological agricultural efficiency will find Minnesota and new producing areas leading the way to more profits from this forest delicacy.

A BALANCE SHEET OF THE MAPLE INDUSTRY

by
Frank Rees, Pure Maple Syrup & Sugar Packers Association
Essex Junction, Vermont

An attempt to define the present position of the maple industry in the United States would seem profitable, since it is difficult, if not impossible, to chart a course in any given direction without a starting point.

A corporate balance sheet is a device for determining financial position at any given time by listing assets and liabilities. Let us apply the same technique to the maple industry and attempt to determine its present position by listing and detailing certain of its liabilities and assets - by reviewing some of the trends and conditions that are "for us or agin us".

An old country medical doctor was presented with a complete and complex chemical report on one of his patients. After studying it for several minutes he turned to the technician and asked, "Is this for us or agin us?" Like the country doctor, your speaker has had some difficulty deciding into which category some of the trends should be placed.

One such trend is that of declining production. From one point of view a diminishing production, with an increase in population, should lead to a consumer demand at high prices, but viewed from another vantage point this supply contraction has resulted in a loss of consumer interest in the product.

In order to chart our present position regarding production, I will quote a few statistics on past production. The census of 1850 shows that cane sugar was at that time produced in nine states, namely, Tennessee, Kentucky, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas, and the quantity produced was 247,577,000 pounds. During the same year maple was produced in 27 states, including all of New England, the Middle Atlantic States excluding Delaware, all the southern states excluding Florida, Mississippi and Texas, and as far west as Minnesota, Iowa and Missouri. In other words, maple was being produced everywhere that the climate would allow maple trees to grow. These states produced 34,253,436 lbs. of maple sugar and 12,700,534 lbs. of maple sirup. If the 1860 production of 40,120,000 lbs. of maple sugar and 1,597,000 gallons of maple sirup, which is equivalent to 64,723,000 lbs., be taken as 100, then the 1952 production in the U. S. of 17,542,000 lbs. would have an index of 26.

This tremendous decline, is, of course, due to a reduction in the number of trees tapped. During the past 17 years the trees tapped have decreased from 12,341,000 to 6,958,000, or a reduction of 43%. The reasons for this declining production are manifold, but it might be well to examine a few of the most important.

Maple production, like so many other farm practices, began on the level of a use economy. Unlike such agricultural operations as grain and fruit raising, and the production of cane sugar, it has remained essentially a household industry. This requires that it be carried on in the country. A U. S. Census survey of April 1947 showed that 83% of American households are now located in urban areas where maple production is impossible. This reduction in farm

population applies to other agricultural products such as milk, grains, etc., but has not resulted in decreased production of these commodities because of the increased efficiencies resulting from mechanization, improved breeding, or other scientific advances. Maple production has not had the advantage of similar improvements in equipment or methods of production. Producers are tapping the same unimproved trees their grandfathers tapped and using essentially the same methods of collection and concentration.

Other factors are high cost and scarcity of farm labor and the high prices paid for maple logs. Many producers have been reluctant to gamble on favorable weather with farm labor asking $1.00 or more per hour if they can realize a quick profit of 3 or 4 thousand dollars from the sale of the bush to the lumber mill operator. Our first liability is an ever decreasing production that threatens eventually to reach the vanishing point.

Canada has not experienced a similar decrease in production, and the importation of Canadian produced maple has become a considerable factor in maple sales in the U. S.

Up to fifteen years ago Canada and the U. S. produced approximately the same amount of maple products, but during the last 10 years the Canadian production has been consistently greater than the United States production. During the years 1948 to 1952, inclusive, the total North American production expressed as pounds of maple sirup was 270,017,000 pounds.[1] Of this amount Canada produced 177,334,000 pounds [1] and the United States 92,683,000 pounds[1], or 34%.

The degree to which Canadian production has been maintained or increased is illustrated by the following statistics which show the average Canadian production expressed as pounds of sirup:

1930-34, inclusive, 29,770,000 lbs.[2]; 1935-1939, 34,892,000 lbs.[2]; 1940 through 1944, 36,436,000[2]; 1945 through 1949, 32,438,000 lbs.[2]; and finally 1950 and 1951, inclusive, 34,398,000[2]. The number of trees tapped has increased, since 19,292,593 trees were in production in 1921 and over 22,000,000 in 1952.

Farm economy in the Province of Quebec, where some 86.5% of the Canadian maple crop is produced, is greatly different from that in the producing areas of the U. S. The percentage of population living in rural areas in Quebec is comparatively high. The revenue derived from the sale of maple products occupies a much more prominent position in Quebec farm economy than it does in the United States. While no statistics on the cost of production in Quebec are available, it is likely that it is far below the approximate cost of 30¢ per pound shown by some recent studies to be the cost in the United States. This, coupled with the fact that in recent years Quebec producers have received, grade for grade, as much as U. S. producers, has encouraged production.

The exportation of maple products from Canada to the United States has increased considerably over a period of years. During the period 1930 through 1940, on the average the equivalent of 5,418,000 pounds[2] or 18% of the total average yearly production of the Canadian crop was exported to the U. S. This increased during the period 1935 through 1939 to 8,614,000 pounds[2] or 25%; in the period 1940-1944, inclusive, it remained 25% but increased to 32% or

10,252,000 pounds(2) in the period 1945-1949. In the period 1950 through 1951 it was 13,829,000 pounds(2) or 40% of the total average Canadian production.

The two factors which have stimulated the above trend seem to have been: 1. The decreased production in the U. S. and, 2. Reduction of U. S. tariffs on maple products imported from Canada.

In 1930 the average price paid to producers for sirup in drums was 12 cents per pound, and the duty on sirup was 5.5¢ and on sugar 8¢. This duty was 45.8% of the average field price. On March 31, 1931 the duty was reduced to 4 cents per pound on sirup and 6 cents on sugar. This represented about 33% of the field price. Under the Reciprocal Trade Act of May 30, 1942 the duty was further reduced to 2¢ on sirup and 3¢ on sugar; this represented 19% of the field price. Under the General Trade Agreement of January 1, 1948 the present tariff of 1-1/2¢ per pound on sirup and 2¢ on sugar was established. This constituted only 6.2% of the field price in 1948 and 5.7% of that paid in 1953.

This then is our second liability. It is made more serious by the fact that most of the imported maple is of the darker grades. A study of the grade distribution in the Province of Quebec for the years 1948 to 1952, inclusive, demonstrates the reason. During this period the production of Fancy sirup ranged from 0.2% to 1.6% with an average of 1.16%(3); Grade A from 9.8 to 25%, average 16.94%(3); Grade B from 31% to 35%, average 33.4%(3); Grade C and below from 40% to 52% with an average of 45.5%(3). In most producing areas of the U. S. in an average season at least 65% of the sirup produced would be table grade. Imported Canadian maple then is not in serious competition for the market for better grade sirups, but, on the other hand, it almost controls the value in the U. S. of the lower grades.

Increased competition from artificial flavors constitutes another liability of the maple industry. Some of this competition seems unfair since they trade on the word "maple" and peddle, in some cases, horrible tasting chemical concoctions that resemble several other things much more closely than they do maple. I suspect that many people in the United States that have never tasted pure maple, or a decent blend of pure maple and cane sugar, have been lost as prospective customers because they assume that the taste resembles that of artificial substitutes.

The United States Army Quartermaster purchases very large amounts of sirup. A "Request for Proposals" dated January 22, 1953 covered 681,000 pint bottles and 140,508 #10 cans of sirup. Maple Imitation Type VII, Class. 2 (30 parts cane sugar and 70 parts corn sirup). If this proposal had specified a sirup produced by blending 15% pure maple sirup with 85% cane, or other sugars, 331,000 pounds of pure maple sirup would have been required for manufacture.

This matter was brought to the attention of Senator George Aiken of Vermont and he contacted the Office of the Quartermaster General in Washington. I would like to read you excerpts from a letter, signed by the Quartermaster Corps Executive Officer, which Senator Aiken received in reply. "The prime reason for not undertaking procurement of sirup flavored with pure maple sap has been on a cost basis. All evidence to date indicates that even when the sirup is composed of a minimum of 15% maple sap, price wise it is not favorably comparable to the imitation product. This office would consider

procurement of sirup with maple sap provided it were priced equally or below the imitation product. Until such time as this condition can be achieved, in the interest of economy the continued procurement of sirup flavored with imitation maple is warranted". It was surprising to learn that the Army was so economical after having read and heard so much to the contrary.

At one time considerable maple sirup was used by the ice cream manufacturers, but artificial flavors have replaced the pure to the point where only a very small amount of pure maple is sold for this purpose. Many other examples could be found to show the inroads that chemical concoctions are making.

This loss of market to synthetics emphasizes the last liability which we will consider, namely high cost of production. Maple sirup, up until 1915, sold for about a dollar a gallon. The price inflation which accompanied World War I pushed the price up to $3 a gallon, but in the early 30's it dropped back to $1. By the end of the 1930's, however, the price had risen to $2.50 to $3.00. During World War II the Government fixed the top price for sirup sold direct by the producer to the consumer at $3.39 per gallon. The price of a gallon of sirup rose sharply after the ceiling price was removed in 1946, and Fancy and #1 sirup sold for up to $6 in the spring of 1947. The price per gallon on direct consumer sales has been between $5 and $6 since that time. One of the chief factors in the price increase is the high cost of farm labor. There is an old adage which states that a gallon of sirup is worth one day's labor; prices of the past have proven this approximately true. In the 1890's, when the going wage for a man was a dollar a day, a gallon of sirup sold for that amount. When wages were at $2 and $3 per day in the 30's, a gallon of sirup brought that amount. Today farm labor receives in the vicinity of $8 to $10 per day, and sirup is about $5 per gallon. On this basis the producer who hires much of his labor during sugaring is receiving less net return now than he did in previous periods. This is especially true if the fact that his darker grades, most of which are sold in drums, bring from $2.50 to $3.00 per gallon. Recent small to average crops and a period of national prosperity have enabled the producer to market his maple crop without difficulty. The only indication of consumer resistance has been the increasing popularity of smaller containers. Some difficulty might be encountered in merchandising a larger than normal crop at these prices. The present high cost of production is unhealthy since it reduces the producer's net profit, increases the gamble on favorable weather, and increases the difficulty of marketing a large crop under present marketing practices.

Let us turn now to a consideration of the assets of the maple industry. First, we have a fine product that has received consumer acceptance since the first settlers were taught by the Indians to tap trees and concentrate the sap. The producer and packer should constantly bear in mind that they are selling flavor and make every effort to see that the consumer is offered filtered sirup of proper density. The packer that manufactures a Grade A sirup from a darker grade by decolorization and foists upon consumers a product with an inferior flavor may do the entire industry a great deal of harm. The Vermont grading law recognizes this fact and specifies that a declaration of decolorization must be made on the label.

Our second asset lies in the fact that the only place in the entire world that maple sirup is manufactured is in a small portion of North America. We do not have to compete with similar products manufactured in European or

Asiatic countries where standards of living are far below those which we enjoy. It is unlikely that maple sirup will be offered for sale labeled "Made in Japan".

Our third asset is the recent interest on the part of several universities, the Eastern Regional Research Laboratory and various State and Federal agencies in the technical aspects of the maple industry. Expert botanists, bacteriologists, chemists, engineers, foresters and Extension Service personnel from these institutions and agencies have already rendered invaluable service, and we expect more in the future. As a matter of fact, the maple industry's hope of writing off some of the liabilities we have been talking about lies in the work and skill of these people. It is hoped that through their efforts we may sometime have maple trees that will reach tapping size in 15 or 20 years instead of 40, thus encouraging the planting/of orchards; trees that will produce sap with a sugar content of 8% or more instead of 2 to 4, with attendant tremendous savings in cost of production; better control of organisms in sap; and improved methods of concentrating, all resulting in better maple products that through improved marketing techniques will result in larger production and sales and a healthy maple industry.

(1) Dominion Bureau of Statistics and U. S. Bureau of Agricultural Economics
(2) Dominion Bureau of Statistics
(3) Quebec Bureau of Statistics

Discussion

During a discussion of the procurement methods employed by the U. S. Army it was pointed out that this Service does not buy premium grade foods but usually buys second grades, only because of cost factors.

THE ROADSIDE STAND AND MAPLE FESTIVALS AS RETAIL OUTLETS FOR MAPLE PRODUCTS

by

Ture L. Johnson 1/
Ohio Department of Natural Resources, Burton, Ohio

(Summary)

The Chardon Maple Festival in Geauga County, Ohio, was initiated in 1926 and has been functioning annually since then. The Festival Board, which consists of 15 members, organizes the programs and arranges for the various merchandising, advertising, and recreational features. The fixed operating expenses are in the order of $6,000 to $8,000 annually, the biggest items being the erection and fitting out of the main tent and sugar house. To defray these

1/ Mr. Johnson substituted for Mr. Tom White of Chardon, Ohio, who was not able to attend the meeting.

expenses the festival sells maple sirup, maple creams, sugar cakes, and stall space within the tent at $10 per foot. The festival buys good quality sirup from the various producers and packages it in quarts, half-gallons and gallons labeled with a special festival label. In the four days they sell from 3,000 to 4,000 gallons of sirup. The sirup is guaranteed against spoilage and is replaced if it is found to be damaged.

Chardon is located at the junction of five main roads. During festival week all of these roads are lined with cars going bumper to bumper for eight or so miles in each direction. Lack of sufficient parking facilities keeps many people from attending the festival, since they are forced to pass through Chardon without stopping. People come all the way from Akron, Canton, Mt. Vernon, Elyria, Sandusky, and Cleveland. They also have special trains from Akron bringing visitors to the festival. If you can imagine 150,000 people in a village of 2500 you will get an idea of the immensity of the crowd.

For entertainment and amusement they have special events which are of interest to both the adults and the young people. These include the Golden Wedding, maple contest, high school band concerts, street dances, "Rube Band", antique show, wood cutting contests, and horse pulling contests. For the youngsters there is a merry-go-round and train rides. All communications, including telephone and public address systems, are in charge of the various Boy Scout units which are in encampment at this time. The festival gets wide publicity, since the program is covered by both TV and radio. The dignitaries taking part in the program include the governor and senators.

The festival has been greatly responsible for the change in the methods of selling sirup. Before 1945 most of the sirup (50-60 percent) was sold in bulk and exported to processors in other states. At present less than 10 percent of the 300,000 gallon crop is sold in bulk. Most of it is being sold retail at roadside stands or by mail order. Interest in production of quality sirup is maintained by the sirup contest. A silver cup is offered to the best sirup produced. This cup can be retired after it is won three times, which need not be consecutive. It is interesting to note that in 27 years the cup has been retired only once.

Discussion

It was brought out that although the volume of sirup handled at the festival is small (3,000 to 4,000 gallons from a total Geauga County production of 300,000 gallons), yet the publicity, advertising, and increased return for retail sirup has opened the way for general retailing. Mr. Clyde Smith commented that a festival is an excellent way of stimulating retailing. Mr. Charles Hubbell reported that he was so curious about the Chardon Festival that he drove out there to see it function.

WHAT ASSOCIATIONS HAVE DONE AND CAN DO FOR NEW YORK MAPLE PRODUCERS

by
Fred Winch, Jr., Extension Forester
Cornell University, Ithaca, New York

(Summary)

New York State has been a large producer of maple products for many years. One hundred years ago when New York was the leader in maple production, maple sugar was the common man's sugar in the maple region, and Cuban sugars were the more expensive luxury product. Now the opposite is true.

Now with the rapid increase in population a greater percentage of the population of urban and suburban areas have forgotten or tend to forget the true maple flavor.

While the other maple states have had maple producers associations for many years, New York State, while it has had all sorts of associations for many of its farm products, has not had a maple producers association. The producers spoke and marketed their products as individuals.

Several factors combined to bring about the formation of the three regional associations in New York--the Western, Central and Northern, covering the three definite and distinct maple regions. These were:

1. Increase in amount of fancy and No. 1 from 10% to 85% of total maple sirup, due to improvement in techniques.

2. Maple products lend themselves to marketing.

3. Legislation proposed for maple producers without previous educational program.

4. Insects, such as tent caterpillars, threatening a whole region.

5. Need of publicity to advertise maple region and resources.

What have these associations done? In regard to publicity, use has been made of newspapers, radio, television and fairs to publicize maple products. In all the above publicity media it has been the attempt of the producers to publicize the industry and not the individual.

At the instigation of the directors of the association, aerial dusting was used successfully to combat an epidemic of forest tent caterpillars in the north country.

Meetings such as directors' meetings, summer picnics, and producers' tours on sugar bush improvement have been held, resulting in closer cooperation of producers.

Where can the associations go from here? The associations can and must take the lead in proposing legislation to control both the associations and their product. Education must be carried on to maintain standard quality. These

should be constant contact by newsletters of an informal nature. Publicity must be continued and expanded. Expansion in the industry should be encouraged among those in the business and among farm youth. The association should act as a clearing house in regard to orders so those who have more orders than they can fill will pass them on to other producers in the association.

In New York State the associations have worked very well so far. Publicity has done a good job of acquainting people with our product. More frequent meetings have brought out new ideas and resulted in their being put into practice.

Discussion

In reply to a question as to what was the largest factor accounting for the rise in quality of sirup in New York State, Mr. Winch replied that this was due mainly to educational programs, smaller crop, and better technique in handling sap and processing it.

The question of the possibility of a statewide organization was discussed, and Mr. Winch pointed out that, because of the considerable territory covered and the different geographical conditions, the present system of three associations with meetings on a director's level was the best method of contact for the maple producers of the state.

CURRENT PROJECTS OF THE VERMONT SUGAR MAKERS ASSOCIATION

by

Clyde N. Smith, Vermont Maple Sugar Makers Association
Burlington, Vermont

I wish to extend greetings from some 4,000 maple producers in Vermont who are vitally interested in research work and the resulting progress in the maple industry. The maple industry is of major economic importance to possibly one-third of the farm population in Vermont. It is the fifth largest source of agricultural income in the state, following in importance dairy products, forest products, meat animals and poultry, respectively.

Organization. This Association was originally organized in January, 1893. We are enjoying our 60th year as an organization which has had growing pains, up and downs during various periods of time, has been incorporated, lost its charter, and been reincorporated. It has had its greatest growth during the past few years.

Among the original objectives of the Association were to (a) improve the quality, (b) increase the quantity and (c) protect the manufacturers and consumers from the many fraudulent preparations placed on the market. A further promotional factor at the time was to put on a maple exhibit at the 1893 World's Fair in Chicago. It was further proposed to promote the general welfare of its industry by publicity and better organized marketing.

These original objectives have been the foundation on which the Association was built and has since been maintained. Additional objectives and activities have been incorporated down through the years. Progress has been made in improving the quality of maple products as a result of the use of technically improved equipment for the faster evaporation of sap. Adoption of better

filtration techniques and facilities for producing sirup of standard weight for packaging in attractive containers of smaller capacities to meet consumer requirements and interest. Public appreciation of the results of these and other efforts has been the basis for general increasing demands for these better products.

In Vermont as elsewhere there has been a decreasing number of trees tapped and a somewhat corresponding drop in production. Many maple orchards have been cut off, to explain in part reduced tapping. Recent reports would indicate, however, that possibly not 50 percent of available trees are being currently tapped in Vermont for widely varying reasons. Costs of additional equipment, high labor costs, questionable economic returns, and many other factors are involved.

The Association has undertaken to secure and justify increased membership participation in many activities. The affairs of the Association as currently set up are in the hands of two directors from each county, one being elected each year for a two-year term. This board elects from its own group a President, Vice President and Secretary-Treasurer, who with four additional directors make up the Executive Committee. This group directs activities of the Association between meetings of the full board.

Membership. This fluctuates somewhat but has varied in total participation only within 12-15 percent of the estimated total number of maple producers within the state. We are faced with a loss of 25 to 40 percent of members each year for varied reasons, but we pick up usually a few more new members than we lose. Some drop off for a year or so and later renew their membership.

Lithographed Cans. The Association undertook to help correct a situation where tin cans with widely varying capacities were the only ones available for local distribution. We secured cooperation from a can manufacturer to supply the Association with attractive lithographed cans with proper capacities for hot packed sirup. This necessitated an investment of about $2,600.00 for preparation of plates before the initial can came off the production line. These cans are available only to Association members.

Crop and Price Reporting. Activities as previously reported 3 years ago are continuing.

Financial. In my judgment there must be some method devised to secure additional revenue or funds from more of the industry if a sound promotional program is to be continued. A relatively few stalwart producers and members have contributed of their time, abilities and funds to help support and initiate new activities during the sixty years of Association organization. A much wider base of income becomes increasingly necessary for progress. The Association has developed from a budget of less than $1,000.00 a few years back to an operating income and outgo budget in excess of $30,000.00 last year, about $25,000.00 of which was turned over by the Manager to the Treasurer, the balance secured from our Eastern States Exposition booth operation. We closed our 1953 fiscal year with a net worth of better than $8,000.00, mostly in inventories. The Executive Committee retired my salary connections with the Association as of October 31 but requested me to continue with title intact to handle our maple booth and maple sugar on snow project,

in connection with the National Grange Meeting in Burlington last week with registration up to Friday night of more than 10,000, and further to attend this conference as Association representative. Three years ago President A. L. Smith attended the conference, and although his term terminated two years ago, Roy is here again at the request of the Association. Since I am not fully informed of current project plans underway or approved for the coming year, I am requesting Roy to tell you about current and prospective projects for the coming year.

Report by A. L. Smith. Although there are about 4,000 producers in Vermont, only about 400 belong to the Association. It should have 2,000 members in order to do an adequate job for the Vermont maple industry.

One of our biggest projects is the exhibit at the Eastern States Exhibition. We select only the best quality sirup and sell from 1,000 to 1,200 gallons of it at $6.00. Some is in gallon units, but most is in quarts and pints. Three men were continuously occupied in making maple sugar cakes at the booth. This was a highly popular product. Total sales were $19,000.

Most of our assets of $8,000 are in can inventories. We need more working capital, and this means more members.

OIL-FIRED EVAPORATORS: DO THEY FILL A NEED IN SIRUP PRODUCTION?

by

Chas. R. Hubbell, Jefferson, New York

(Summary)

As we think of the maple sirup industry, it brings back memories of a wood colored building among the maple trees located on a slope in the sugar bush. Quite often this building is some distance from the other farm buildings in order to be handy for collecting the sap.

It is generally essential to have a high smoke stack in order to have a draft and pull enough to make the fire burn rapidly. Our college foresters tell us that every sugar bush should have enough cull wood every year to keep the evaporator in fuel. Some years you will hear a producer say, "I've had to take my buckets down; I am all out of wood." Here is where the oil-fired evaporator is coming into its own.

About 14 years ago I was faced with the problem of giving up the sirup business or converting to some kind of fuel other than wood. I rent approximately 90% of the trees I tap. I had used up all my available wood in my own bush of 400 trees and picked up all the old boards and timbers from a dilapidated building in the nearby village.

I finally decided to try a commercial oil burner in a 5 x 14 evaporator, Luckily, my sap house was wired for electricity and along the road side where it was accessible for oil delivery. I believe I was the first person in New York State to convert completely to oil, so just how to brick it up and how much oil to use, etc., was a matter of experimentation. It was something new for anyone to boil sap with oil, and lots of people were skeptical about it and came in to see it work.

Along with the boiling by oil, a little experimental work was being tried out, such as shutting the burner off when sirup was being drawn off to keep the temperature of the sirup from running up too many degrees. Our smoke stack was equipped with a mercury switch which was supposed to take care of the ignition automatically.

The burner was shut off to draw off a batch of sirup, and when switched on, nothing happened for a moment. Then everything happened. A loud explosion rocked the building. The oil burner was blown back out of the arch, the pans were askew, and a hole was torn in the smoke stack where a heavy iron struck it by the explosion. Luckily no one was hurt or burned by the hot sirup.

What happened was that the fresh fuel was being sprayed on the hot bricks, and no fire to ignite it; then all at once the delayed ignition came along, and presto!

The news spread like wild fire. People said, "I told you so," etc. There was a rumor around that it blew the pans right through the roof, and people came down from the village to see the damage.

Like everything else, the damage was soon repaired, and we were boiling again as soon as a new stack switch was installed.

In the first burner I used old motor oil mixed with the fuel oil at the ratio of 1 to 4, which worked very well, reducing the cost per gallon for fuel, but after a while it got rather messy and I discarded it.

The first burner was installed in the front of the evaporator. I wanted to experiment a little more so I took that one out and installed two ordinary house burners at an angle, one on each side. This worked fairly well, but where the blaze of the two burners met there was too much heat. The ratio of oil consumed per gallon of sirup was about the same as with the commercial burner, but it took about one-third longer to boil a given amount of sap.

As the years rolled on, I purchased two new commercial burners capable of burning 15 gallons of oil per hour. I installed one on each side of a 5 x 14 evaporator in front and had a separate fire box for each one; and, mindful of the other explosion, I built a small opening between the two fire boxes where I would always have a blaze to ignite the oil on either burner. Each burner is wired up separately and is manually controlled. I did away with the stack switches. I can draw sirup off on either side by shutting off the burner on the sirup compartment side, and in this way the sirup can be taken off without running up too many degrees.

Cold sap can be brought to a boil within five minutes from the time the switch is thrown, and the sap will stop boiling almost the moment the burner is shut off. With oil burners there is no variation in the boiling process, no opening the fire doors to slow down the boiling, the direction of the wind has no bearing on the fire or draft, and a tall smoke stack is not essential. The accuracy of boiling is so correct I can estimate within 15 minutes the time it will take to "boil in" a given amount of sap, such as 1000 or 1500 gallons.

The simplicity of the oil-fired evaporator permits me to operate two large evaporators simultaneously and have ample time to filter the hot sirup and can it, besides visiting with the stream of customers who are always curious to see something different than grandfather used to do.

There is still room for lots of improvement in the oil burning evaporator. One thing that should be taken into consideration is the insulation of the evaporator. Most every producer that uses wood has seen his fire box doors red hot at one time or another and what a tremendous amount of heat is lost in that way. On my evaporators, I can put the palm of my hand on the front side where the doors usually are without being burned, while drawing sirup off every 10 or 12 minutes.

Some of the evaporator companies have been urged to build an evaporator especially for oil burning, since the demand is getting greater every year. There would have to be an entirely different design from those on the market today--a unit that would be complete in itself. An outfit such as that would run into too much money for the average sirup maker, and there would not be enough sales for them.

In regard to the cost of operating an oil-fired evaporator, most people who have not used one would say they are expensive to operate. They say oil costs money, but so does labor. In 1947, the late Josh Cope, Extension Forester of Cornell University, ran a cost survey of producing sirup in New York State. A questionnaire was sent out to 20 producers scattered throughout the state. Each man was to keep a record of all time spent in cutting wood, storing it in sap house, tapping trees, washing buckets, etc. It was found that the average cost per gallon of sirup for wood fuel was 42¢ per gallon. I have kept an accurate cost account in the past few years, and in 1951 I used 3.47 gallons of oil per gallon of sirup at a cost of 47-1/2¢. Oil was a little higher in 1951 than in 1948 and is still higher now, but so is labor. It is a lot of back breaking work to cut, haul and pile enough wood to make 1000 gallons of sirup, whereas I call the oil man on the phone and in half an hour I have a load of oil, and if necessary another tomorrow. I always have enough fuel regardless of whether we have a good or poor season.

More producers are converting to oil every year--even those who have plenty of wood for fuel. A wood-burning evaporator requires a large storage space for fuel; it requires a high smoke stack, as well as plenty of room in front to stoke the fire. It's a man's job to fire the evaporator, and a hot job at that, to say nothing about carrying out the ashes and cleaning the flues every day. All the space that is needed for oil is about two feet in front of the evaporator for the burner; the oil can be stored underground or outside. A smoke stack just out the roof is sufficient. Have the switch in a convenient place and plenty of sap ahead, and you are all set.

Perhaps you will wonder what it costs to install such an outfit. A conservative figure would be $500, and if you are at all handy with tools, that figure can be cut down considerably. The burner, oil tank, wiring and insulation brick is all that's needed. In my sap house I have three large burners in two evaporators all running at once. They will burn a lot of oil in 10 hours--300 gallons more or less. On the other hand, I will make 100 gallons of sirup in that length of time. I also have an extra burner in case one plays out during a big run of sap.

During this interval of 14 years using oil burners, I have experimented with both flu pans and flat pans over the hottest part of the fire. In fact, I have one of each at present on the front part of the arch; and in all fairness, I can say that the flat pan boils just as fast as the flu pan, but the flu pan works better on the back of the arch. If I were to buy new front pans today they would be of the flat type. They only cost about half the price and they could be replaced more often.

From my observation on the use of oil for fuel during these years, I am thoroughly convinced that the oil-fired evaporator fills a need for the sirup producer. Summing it all up, there are no ashes, no labor required, no large sap house to maintain, plenty of fuel to be had, and always steady boiling just by pressing a button. What could be easier for the sirup producer?

A NEW TYPE OF SAP EVAPORATOR

by

R. K. Eskew, Eastern Regional Research Laboratory

(Presented by R. P. Homiller, Eastern Regional Research Laboratory)

My remarks should more properly be entitled a "Progress Report on the Development of a New Type of Maple Evaporator." Our work in this field is so preliminary that we cannot yet judge the practicability or utility of the type of unit which we have in mind. However, as you will soon see, the appearance of the experimental unit and its method of operation are so entirely different from the conventional system that it seemed worthwhile to make mention of the work at this conference, as it may give rise to some constructive suggestions.

When you make maple sirup in the conventional way you carry out two operations simultaneously--the removal of water and the development of maple flavor. It was our thought that if these two operations could be carried out independently that we could control each of them better. As some of you may know, we have done a good deal of work at this Laboratory on the engineering design of equipment for very rapidly concentrating fruit juices at atmospheric pressure without heat damage. In this new maple evaporator we have attempted to apply some of the same principles. The rudimentary idea was to concentrate the sap to sirup strength without altering its color or flavor in a matter of a few seconds, thereafter holding the sirup at the optimum temperature for developing the desired color and flavor. Before going further I should explain that the type of evaporator we have in mind would not ordinarily be practical for farm use because it requires a source of steam. It might, however, be useful at a centrally located cooperative, where it could convert to sirup sap which had already been partially concentrated on the farm. The thought now is that farmers could use their present evaporators to convert sap to sirup of say 20-30% solids. This could probably be done without the careful control now required for making sirup, because it has been reported that not much color or flavor is developed at these low sugar levels. The volume of the sap would thus be reduced to about one-tenth the original and it would be more sterile than fresh sap, so it could be conveniently transported to the cooperative. There final concentration and development of flavor would be done by the special evaporator.

Before going further, let us have a look at a slide of the unit. You will have an opportunity to see it in the pilot plant later on. Into the feed tank would be put the partially concentrated sap. This would be fed by a pump at a constant rate through a rotameter, which is a flow metering device, to a preheater. The preheater is simply a small diameter steam jacketed tube through which the liquid would flow at a very high velocity, perhaps 20 feet a second. Its temperature would be raised in a few seconds to its boiling point, which under these conditions would be about 214°F. It would then enter the vaporizer, which is built just like the preheater except the tube is of larger diameter to accommodate the tremendous expansion in volume that takes place when we vaporize in a single pass all of the water necessary to bring the sirup to 65.5 Brix. Steam of 50 to 100 pounds pressure can be used in the jacket of the vaporizer. The mixture of sirup and vapor bursts out at a high velocity into a centrifugal separator. The steam vents to the air from the top of the separator and the hot sirup runs out the bottom into an insulated holding chamber where by an arrangement of drawoff valves it can be retained any desired time to develop color and flavor.

You may wonder why I speak of deliberately developing color, when in general lighter color sirups command a premium price. It is because when sap or partially concentrated sap is converted to sirup in this apparatus the resulting product is extremely light in color. In consequence, it is possible to take sap, which would give dark colored sirup if boiled in an open pan, and convert it by this rapid evaporation to a sirup having the color of "Fancy". It does not follow, of course, that we can afford to neglect care in collecting good sap, for we all know that although color is an important factor in the price of maple sirup it is the flavor which makes maple unique and permits it to command a price far above its value as a mere sugar sirup.

It is on this point of flavor that we have struck a snag. We can make some mighty nice looking sirups from even mediocre quality saps, but nothing we have yet produced possesses to any marked degree that characteristic maple flavor. This brings us right back to the need for more fundamental information on the essential substances and the optimum conditions of time, temperature and concentration under which they should be interacted to produce good maple flavor. This type of research is being carried on by chemists at the Eastern Regional Research Laboratory and probably elsewhere, but it is a long range problem. With slight modifications in the apparatus which has been described it would be possible to develop flavor by heating at whatever concentration proves best, whether this is before or after reaching sirup density. Pending basic facts as to where such heating should be done, we can only operate by trial and error.

One of our serious problems has been that of providing an out-of-season source of good sap for experimental use. In spite of our attempts to preserve sap, carefully collected in the immediate vicinity and subjected to freezing, pasteurization or vacuum concentration, we have not yet been successful in regenerating it out of season. It is unsatisfactory in the sense that by none of the means at our disposal have we been able to produce a good maple sirup from it. Hence, much of our difficulty in working with the new evaporator may be attributed to the lack of a good raw material. We have not yet had the opportunity of trying it out with fresh sap or an intermediate product made from fresh sap. We plan to do so in the field next Spring.

I trust that by the next maple conference we will have concluded as to whether there is any practical value or not to this approach to the problem of making uniformly good sirup from sap which of necessity varies in character throughout the season.

SOME CHANGES THAT SAP UNDERGOES IN A CONTINUOUS ATMOSPHERIC EVAPORATOR

by
C. O. Willits, Eastern Regional Research Laboratory

(Summary)

This study was undertaken to answer such questions as: why is it not possible, under most operating conditions, to draw sirup continuously from the evaporator, or why, when two identical evaporators, each operated by a sirupmaker and fed from the same sap storage tank, two grades of sirup are obtained.

Because the steep portion of the boiling point elevation curve occurs in the region of standard density sirup and since sensitive thermometers are available, it is possible to determine with high precision when evaporation of the sap has proceeded far enough to yield standard density sirup. A change of 0.5°F. corresponds to a change of 1.25% in sugar content, and with an open scale thermometer this temperature can be read with an accuracy of less than 0.5°F. Furthermore, sirup of standard density tends to resist the loss of water. During boiling, sugar solutions of 60% sugar content lose water only 1/3 as fast as solutions containing only 10% sugar. Both of these factors should favor continuous draw-off of sirup. Therefore failure of the evaporator to operate with continuous draw-off is due to some fault in the technical design of the evaporator.

From previous work reported in our publication "Maple Sirup V. Formation of Color During Evaporation of Maple Sap to Sirup," we learned that the color produced in maple sirup is a function of the time that sap is boiled until a solid (sugar) concentration of 45% is reached. Above this concentration both the sugar and time of boiling affect the color.

This means that we had to know (a) how long the sap solids remained in the evaporator and (b) something of the change in the concentration of the sap as it moved through the evaporator pans. This required taking simultaneously a large number of samples at fixed points throughout the evaporator, and then repeating the sampling at definite time intervals over a long time.

The sampling posed a real problem and was solved by making a special sampler of the thief type, consisting of a test tube having a hole in the bottom and a glass marble check valve. With these samplers 48 samples were taken simultaneously. To measure the time that sugar remains in the pans, the evaporator was put in operation and, after it had reached equilibrium, that is, it was making sirup, lithium was added to the sap storage tank and the first series of samples taken. A new set was taken every 20 minutes.

From the analysis of these samples we learned that some of the lithium passed through the pans and was in the drawn off sirup in less than 20 minutes. Since the concentration of lithium found was far below that which it would be if it had been concentrated the same amount as the sugar solids, it

indicated that the sap was not moving through the pans in a steady front. It did indicate that the sap in passing through the pans was subject to surging and intermixing. The lithium analysis also indicated that at least 50% of the sap solids remained in the evaporator at least 120 minutes. It took 160 minutes to move 98% of the sap solids through the sap pan. The solids are removed from the sap pan as an exponential function with 1/2 being removed in the first 20-40 minutes. On the other hand, in the sirup pan it took 140 minutes to move 98% of the solids through it, but required only 70 minutes to move 1/2 of the solids through this pan.

The analysis of these same samples for sugar revealed three most important facts that none of us had suspected. (1) In the sap pan there is essentially no gradient of sugar increase from the point of sap intake to its exit. The sap immediately assumed a sugar level of 8% and maintained this throughout the pan. (2) This indicated that there is no frontal movement. Instead, the sap in this pan acts as if it were in a kettle under such a violent state of agitation from the boiling action that the new sap is immediately and intimately mixed with that which is already there. (3) The concentration effected in this pan was slight--in the case of this experiment, 4% to 8%. However, this results in removing more than 50% of the water, leaving less than 50% to be removed in the sirup pan.

The sugar data of the samples taken in the sirup pan showed: (1) Unlike the condition in the sap pan there is a steady increase in the Brix from the time the sap enters until it is drawn off as sirup. (2) The rate of change in sugar concentration is greatest in the range of 15° to 65° Brix. These occur in that area of the pan which is exposed to the greatest heat flux. (3) The rate of concentration change is slowest at both sides of the pan, at concentration levels of 8-15% and 60-70%. (4) The most important disclosure was the non-uniformity of sugar concentrations at any one sampling point, with concentrations varying as much as 25%.

The analysis gave a ready explanation of why some of the sugar, as indicated by the lithium tests, can pass through the sirup pan in as little as 20 minutes while some remains in the sirup pan for more than 2 hours. Even more important, it explains why it is so difficult to withdraw standard density sirup continuously from the evaporator.

This undesired effect of surging might be corrected by (1) Removal of sirup from the evaporator continuously, even though its density is fluctuating but keeping it below that of standard sirup. Then collect this sirup and finish it off to standard density batchwise. (2) Change the width of the channels in the sirup pan so as to cause a more nearly uninterrupted rate of flow. Our Engineering Division has done this by putting two wiers in the last channel of the original sirup pan. Samples taken from this modified pan showed that the narrower channels caused the fluctuations in sugar concentrations at any one of the different sample points to be less than 2%.

The great improvement in constancy and rate of flow with this first modification of an open pan evaporator indicates that with a steady fire, such as with oil firing or carefully controlled wood firing, evaporation of the sirup can be caused to take place at a steady rate with the sirup moving through the pan with a well defined front, and that standard density sirup can be withdrawn continuously from the evaporator.

We all knew that sap is slightly acid, pH about 6.5, and that sirup is also slightly acid. Professor Bois had observed that sap becomes alkaline during its evaporation cycle, but we did not recognize the importance of this pH shift, nor its relationship to other reactions. When we plotted pH and color formation (color index) curves on the same graph we noted that very little color develops until there is a sharp increase in the pH. After the pH has reached a maximum and is strongly alkaline there is a correspondingly steady and rapid increase in color. Thus color of maple is due to time of boiling the sap, the concentration of the solids during this boiling period, and to the pH of the sap.

We have not attempted to correlate these analytical data to flavor development for we did not know of any means to measure the flavor of sap of different concentrations. However, in the past few days we have some indications that we may be able to do this. If so, we will report such correlations at some future time.

Discussion

In answer to a query as to the effect of placing baffles in other parts of the evaporator, Dr. Willits replied that it is planned to do so and that this account is merely a current progress report. In view of the results shown here it was suggested that the difficulties which prevent continuous "draw off" of sirup be corrected before further studies be made of an automatic draw off.

Asked if anything has been learned about the changes in flavor, caramelization, bacterial flavor or amount of flavor produced while the sap is being evaporated, Dr. Willits answered that some of these topics dealing with the nature of the flavor were to be answered by Dr. Porter and that as to the others we still have no information.

The question was raised as to the kind of heat used in the experiments. On being informed that oil heat was used, it was asked whether the same results could be expected with steam or wood. This was answered by saying that with the heat source constant the results would be much the same irrespective of whether it be wood or steam. However, since in the case of wood fuel the fire usually shows more fluctuations than that of oil, the changes in the sugar concentrations by surging would be greatly exaggerated.

As to the cause of the pH cycle as sap is evaporated, it was pointed out that the sap is acid due to dissolved CO_2 and as it is removed by boiling, the sap becomes alkaline, and then again becomes acid due to the breakdown of sugar to sugar acids.

A REPORT OF CONTINUING BOTANICAL RESEARCHES ON MAPLE SAP AT THE UNIVERSITY OF VERMONT

by
James W. Marvin, University of Vermont
Burlington, Vermont

(Summary)

The earliest scientific studies of sap flow were made in the 1870's by President Clark of the Massachusetts Agricultural College. The next were by Jones and Hills at the Vermont Station about 1903. Then, after another gap of 30 or more years, Marvin and Taylor at Vermont again took up the research. In 1943 they set up a broad prospectus of projects, ultimately to cover such topics as variations in sugar concentration and flow, genetics, growth requirements, diseases, and physiology of sap flow. A 200 acre farm, part woods and part upland meadow, was acquired for this project. Outsiders are welcome to use this facility. The present talk covers various phases of the physiology of sap flow.

Performance per tree. No tree has a constant sugar concentration in its sap; it varies considerably from year to year. However, each tree maintains its rank among the neighboring ones year after year. This may indicate a genetic basis for sugar content.

Sap flow. Roots are not necessary for sap flow. They are, of course, necessary for replenishing the sap over a longer period. Sections of trunks and branches can be made to secrete sap, and many of the Vermont researches are made with such sections in a box with temperature control. It is not necessary to freeze the sections to get sap flow, but a rise in temperature is required. Bark must be on the stem sections or no flow will result. If the sap in the stem section is replaced by water, there will be no flow. If replaced by sap from another tree, or by a solution of sucrose, there will be flow. But solutions of some other sugars will not cause flow.

Field laboratory. Two buildings were erected on the experimental farm. One of the buildings houses typical sirup making equipment, but with provisions for experimental variations. The other houses recording equipment used in the sap flow studies.

Thermocouples are inserted in a number of different trees in the bark and wood and in small branches in the crown. Wires lead to automatic recording devices in the instrument house. Flow rate is also automatically recorded on similar charts. (A chart of these data, about 12 feet long, was exhibited.)

After collecting such data for 5 years, some 600,000 observations are on record. In order to study and interpret these data, Dr. Marvin is on leave of absence from the Vermont Station and is in residence at the botany department of the University of Pennsylvania.

A casual glance at the charts, however, shows some of the relations between temperature and sap flow. Almost invariably, when temperature is going down, sap flow ceases; it fails to flow as long as the temperature remains constant; when temperature goes up, flow may start again. However, the rate of flow is not proportional to the amount of rise in temperature, since a few degrees rise may be as effective as a rise of many degrees. Dr. Marvin thinks in

terms of a trigger mechanism here. During the low temperature, non-flow period, sap pressure in the trunk may be less than atmospheric. During the rising temperature, flow period it may go up to 15 or 20 pounds per square inch.

Other items for research. Trees should be selected for high sugar and high flow and rapid growth rate, although high sugar is by far the most important, because of the cost of evaporation. It is of great importance to learn how to root cuttings of clonal material. Such clonal stock will make possible the evaluation of the part played by genetics and environment in such important qualities as sugar concentration, flow rate, growth rate, site factors and even perhaps flavor.

Discussion

The effect of barometric pressure has not been studied, but Dr. Marvin believes it would show no effect.

There are some observations that humidity and wind may affect water loss from the crown and thus affect flow, but this has not been studied.

Some observations were offered to the effect that the first year of tapping a bush gives the best flow and the highest sugar. Others, however, contributed contrary evidence. No one has noted a general decline in production over a period of many years of tapping.

FACTORS INFLUENCING THE PRODUCTION OF HIGH QUALITY MAPLE SAP. A PROGRESS REPORT

by

P. W. Robbins, Michigan State College
East Lansing, Michigan

(Summary)

This progress report covers some of the research activities carried on by the Forestry Department of Michigan State College in cooperation with the Maple Products Section, Biochemical Division of the Eastern Regional Research Laboratory under a contract as authorized by the Research and Marketing Act of 1946.

Compass position of tap hole in relation to volume of maple sap production and damage to the tree. The 1953 research project verified one of the phases of research work conducted by the Forestry Department during 1934, 1935, 1937 and 1938. The four seasons in the Thirties with records of sap weights from approximately 400 buckets annually, and the 1953 season weights from 168 buckets gave average daily flows of maple sap as follows:

	1934-38 (in pounds)	1953 (in pounds)
North quadrant	6.6	5.4
East "	8.5	5.3
South "	8.3	5.9
West "	8.4	5.7

The total flow in gallons for the 1953 season by quadrants was: South, 16.3 gallons; West, 15.8; North, 15.0; and East, 14.8 gallons.

This demonstrates that maple sirup producers may tap any maple tree year after year, in different quadrants, varying the height of tapping periodically, and maintain high quality and high volume production without serious damage to any one quadrant of the tree.

The producer who concentrates tapping on the South or West quadrant will often strike an old tap hole or scar tissue which has been covered with new bark and get a dry hole. The area around an old tap hole contains more discolored and decayed wood, in which it is believed microorganisms multiply more rapidly than in new sapwood, and therefore a tap hole in such an area not only produces less sap, but low quality sap.

Height of tap hole in relation to volume of sap produced. In order to test the belief that tapping directly over a large root and at different heights influence the yield of sap, trees were tapped over a large root at one, two, and three-foot heights. The results for one year (1953) from 36 buckets gave the following production in gallons per tap hole for the season:

One-foot	height	above	ground	-	12 gallons
Two-	"	"	"	-	18 gallons
Three	"	"	"	-	17 gallons

This experiment will be continued for three years and should yield recommendations as to tapping heights.

Tap hole depth in relation to maple sap flow. This project investigated sap flow from tap hole depths of 2 inches, 4 inches and 6 inches. In 1953 the volumes in gallons produced per tap hole were:

Two-inch	tap	hole	depth	-	16 gallons
Four-	"	"	"		22 gallons
Six-	"	"	"		19 gallons

The author is convinced that the difficulty encountered in drilling six-inch tap holes as compared to two- or four-inch depth will rule out the six-inch depth of tapping.

All maple sirup producers are aware that weather has a great influence on the quality and quantity of maple sap flow and therefore influence the gross income of their maple sirup operations.

May we accept the premise that the maple sap utensils and boiling equipment are thoroughly cleaned and scalded before the sap season starts and therefore are free or more free of microorganisms than at any later date during the sap season. May we also accept the premise that the very first maple sap runs are the sweetest. Then we may accept that forecasting the arrival of the first maple sap weather will greatly aid the maple sirup operator to produce the maximum volume of the highest quality maple sirup.

The Forestry Department and the Michigan Section of the United States Weather Bureau have cooperatively made sap weather forecasts since 1942. In 1953 no favorable maple sap weather was forecast, and no sap flow from the tapped trees of any consequence occurred up to February 20, 1953.

On February 18 the Weather Bureau determined from the data on weather approaching Michigan that favorable maple sap conditions would occur in Central Michigan on February 20. Therefore the first forecast of favorable maple sap weather was made over Michigan State College Radio Station WKAR at noon on February 19 advising the sirup producers to get their trees tapped by noon on the 20th.

The first maple sap run started as forecast, about noon on February 20. This run produced the largest flow of maple sap recorded for any one day during the 1953 season. A total of 2,250.2 pounds from the 168 tap holes, or an average of 1.6 gallons of sap per tap hole. This first run ended on February 21, producing only 578.6 pounds on that date. The weather continued cold on February 22 and 23, but favorable conditions returned on February 24, 25, 26 and 27 and produced sap runs of 1,258; 1,589; 1,343; and 305 pounds, respectively. The weather turned cold on February 27 and remained in the twenties until March 11, or for a period of 12 days. Maple sap flows occurred during February 20 to 27 and March 11 to April 6. The February production of 7,246 pounds represented 33-1/2 percent of the season's grand total. Therefore the producer who failed to catch the February runs missed approximately one-third of the possible crop.

Our premise was that the first runs produced the sweetest sap of the highest quality; therefore maple sap weather forecasting 24 hours in advance of the first run is one of the greatest services that may be rendered the maple sirup producer to increase the quality and quantity of maple sirup production.

In order to increase the reliability of maple sap weather forecasts the Michigan Section of the United States Weather Bureau and the Forestry Department in the Cooperative Research Project with the Eastern Regional Research Laboratory have included detailed weather recording right in the sugarbush area. The data collected during 1953 look very promising as an aid in forecasting the approach of maple sap weather with greater accuracy.

OPERATION OF AN EXPERIMENTAL SUGAR BUSH

by
Fred Taylor, University of Vermont
Burlington, Vermont

(Presented by Mary T. Greene, University of Vermont)

Since my subject, "Operation of an Experimental Sugar Bush", permits a good deal of latitude, I propose to take liberties with it. My remarks therefore will deal not so much with the operation itself as with the importance to a maple research program of having an experimental farm to operate and the benefits to theoretical studies which come out of association with a practical operation.

As my colleague James Marvin has told you, our research program has as its central theme "the biology of the maple tree." For us, the scope of this subject includes a consideration of the maple tree as a living organism, influenced by heredity and molded by environment. In our thinking it also includes a study of that dilute sugar solution, maple sap, from the time it is produced in the tree until it reaches the evaporator.

As Dr. Marvin has also mentioned, we wrote a detailed prospectus early in our experience with maple and from it have selected topics for detailed laboratory or field study from time to time. We were first intrigued by variation in sugar content of sap, a subject about which there was some general knowledge on the part of farmers who recognized so-called "sweet trees", but who had no definite information on degree of variation or on within-season and season-to-season patterns. Likewise, in the literature there were no reports of extensive investigations which could serve as a broad base for studies involving sugar concentration and its relation to other factors. For this reason, early in 1944 we started a survey of variation in sugar content among some 4500 trees in 9 farm sugar bushes--a survey which, in some of its ramifications, was still in progress during the spring of 1953.

It soon became evident that a companion study on variability in the volume of sap produced should be the next step, since yield as well as sugar concentration is directly involved in sirup production. It is difficult and often unsatisfactory to count on farmer assistance in measuring yields. This is not to say that the farmer is uncooperative. Actually the reverse is usually true. But, such an added burden for the farmer at this busy season is out of the question. Many producer-owners do their own boiling and are occupied in the sugarhouse most of the time. Their labor force in the sugar woods is often something less than reliable for sap-gathering purposes to say nothing of its qualifications for gathering scientific data. We felt, then, that trees not used in a practical operation should be available for detailed volume studies and that volume records should be accumulated by individuals whose primary interest was not elsewhere. A farm such as ours provides both the trees and the opportunity for this type of work.

Furthermore, it was apparent that eventually the vegetative propagation of superior individuals, selected on the basis of both sugar content and yield, would be necessary and that the testing of this clonal material should follow. For this purpose land is essential, and with this end in view the Proctor Maple Research Farm was purchased. Among its approximately 200 acres of potential "maple land" are 60 in upland meadow. This area has been earmarked for planting uniform stock in a variety of spacings, exposures, and soil moisture and fertility levels.

Once the experimental farm had been acquired for the primary purpose of testing clonal material, all manner of smaller projects for utilizing the area's maple population came to mind. Many of them, because of their destructiveness to bearing trees or simply because of their nuisance value, would be out of the question except on property devoted to experimentation.

For example, we had impatiently waited for a long time to get at the problem of sap flow on intact trees in natural surroundings. Some significant physiological observations, made on pieces of maple stems under controlled temperature conditions in the laboratory, needed checking under field conditions. That temperature and flow are related in some way was obvious--but we wanted to find out just where in the tree temperature fluctuations are effective, just what bearing these changes have on the flow mechanism, just how a run is set off in the first place, and just what effect temperature has on the slackening off and eventual cessation of flow. In our own sugar bush, without fear of interfering with a practical operation, it has been possible to set up recording potentiometers and string the necessary maze of wires to selected trees. As a consequence, over a five-year period we have gathered

detailed temperature records for those points in the tree and its environment that might conceivably have significance in the flow mechanism. This information, along with additional weather data, is being thoroughly explored by Dr. Marvin this year.

Temperature records in such detail made the traditional method of recording yields by runs or even at hourly intervals obsolete. We were faced, then, with the necessity of obtaining continuous flow records to match those of temperature. As a result, the instrument already described by Dr. Marvin was developed, whereby both flow rates and total yield may be calculated at leisure from a time-marked chart. Operation of this machine required more wiring. Yet, that which in a farmer's sugar place would have amounted to much confusion and a reduction in efficiency has become, for us, routine procedure.

Another advantage to owning an experimental sugar bush lies in the freedom it gives for full use of trees. Such activities as overtapping, tapping in unorthodox ways, total decapping and other forms of surgery--some or all of which might be productive of valuable data--can be practiced without fear of economic loss to a producer. For several years decapitated trees have been used to study the effects of weather conditions on maple crowns and indirectly on sap flow. Valuable leads have come out of this technique, practicable only in an experimental setup.

Although the long-range goal of our project is tree improvement, our farm provides an opportunity for the study of existing trees of all ages. One of the causes for concern in the maple industry is the ever-present temptation to by-pass the perennial labor problem of sugaring and harvest the sugar bush for timber as a cash crop. Many sugarmakers in the northeast have succumbed. The question immediately arises--what shall be done with these areas which have been stripped in this way? How can these denuded acres, in which maple whips are beginning to appear, be dealt with most effectively? Can or should they be brought back as potential maple orchards? Like many marginal farms in northern New England ours has on it one of these cut-over areas. Here, then, we have the raw material for studying another perplexing maple problem.

Still another area of several acres has on it a stand of older, yet far from mature trees. Some thinnings and fertilizer studies have been started in order to determine how crown development may be modified in the growing tree and what may be done to bring young maples into production in the shortest possible time.

Owning an experimental farm permits access to materials used in related maple research with a minimum of fuss and bother. Sap for biochemical or microbiological analysis is available in abundance for use in our own laboratories or in those of our maple colleagues elsewhere. The use of a surplus freeze-drier has enabled us to quickly reduce sap to a solid with a minimum of alteration. This material, which by-passes the problem of spoilage and requires a minimum of storage space, may be used for reconstituting sap at any season of the year.

In addition, the farm produces cutting stock for use in propagation studies, as well as seeds from trees whose past performance is a matter of record. It also makes available materials for anatomical studies, especially hard to obtain under other circumstances, if entire trees or parts of trees must be sacrificed.

Not the least of the benefits coming out of an experimental sugar bush are those which develop from having a research program and a sugar operation run side by side. Sap from some 1000 buckets, not affected by research activities, is processed as in an ordinary sugar place. Sirup is made on a share basis by a competent sugarmaker under the supervision of research personnel. We are constantly moving back and forth from our recording instruments and testing activities to the practical operation--not in a supervisory capacity but rather to check on developments in the sugarhouse as they may reflect changes which we have already observed. And, strangely enough, the operator of the sugarhouse often checks our instruments, especially the rate recorder, before formulating his plans for the day. Running the two operations, theoretical and practical together, gives the man whose livelihood depends on sirup production an insight into the aims and objectives of the scientist, and it lessens the danger of our little red instrument house becoming a woodland ivory tower.

INFLUENCE OF TREE CROWNS ON SIRUP PRODUCTION

by

Robert R. Morrow, Jr., Cornell University, Ithaca, New York

(Summary)

There is a great variation in sap flow and sugar percentage, hence also sirup production among sugar maple trees and sugar bushes. Heredity, exposure, and soil must certainly cause some of this variation. So also does the size of tree and tree crown.

Influence of tree crowns on the sugar content of sap. Sugar maple trees and bushes exhibit great variability in the percentage of sugar in the sap. Both live crown ratio and crown diameter are positively correlated with sugar percentage. In closed sugar bushes most of the crown influence on sugar percentage was found by measuring the crown diameter. In open sugar bushes both the crown diameter and live crown ratio were useful in measuring the crown influence. The degree of openness of the sugar bush exerts a positive influence on sugar percentage over and above the size of the crown itself.

Influence of tree crowns on sap flow. There is considerable evidence that sap flow also is correlated with crown size, and in much the same degree as sugar percentage.

Influence of tree crowns on sirup production. A study of 30 sugar bushes showed that sirup production per bucket is increased in proportion with increases in average crown diameter. Sirup production per acre is about the same regardless of the size of the tree crowns. Increased sirup production per bucket, however, results in considerable savings in the costs of sirup production.

The Ideal Sugar Bush

The results of this study indicate that one should aim at the development of single large-crowned trees, rather than aim for a certain number of trees or production per acre. By this procedure the ideal sugar bush will be developed,

Thinning should be started before trees are 4 inches D.B.H. (diameter breast height) and should be heavy and often enough so that crowns are kept relatively free of each other. Subsequent thinnings should follow often and they will be lighter and less dangerous than the first thinning. Less can be accomplished when thinning is delayed until the trees are larger. Older sugar bushes are less vigorous and should be thinned more lightly.

The ideal sugar bush involves considerable planning for its development. In planning new or improving existing sugar bushes, it is best to concentrate on areas near sap house or roads,while more inaccessible trees may be grown for timber. Good soil and exposure conditions should be selected. Then the trees can be thinned to aim at the following eventual goals, applicable especially to the regions studied: Nearly even-aged stand, crown diameter 40 feet, live crown ratio 90%, 25-30 trees per acre, 80-100 buckets per acre, 0.4-0.5 gallons per bucket, and 40 gallons of sirup per acre per year.

NOTE: Reprint of his complete paper may be obtained by writing to the author.

Discussion

The discussion centered mainly about the problem of thinning in sugar stands. Emphasis was on the fact that thinning should be done before the trees are 4 inches in diameter, and less thinning can be done with older sugar bushes.

Several producers reported that sugar bushes which they thinned over 25 years ago have shown an increase in sugar content and production as compared with stands that weren't thinned.

THREE YEARS OF PROPAGATION OF MAPLE STOCK BY VEGETATIVE CUTTINGS

by
Stuart Dunn, University of New Hampshire, Durham, New Hampshire

(Summary)

A project on propagation of sugar maple by cuttings was started several years ago at the New Hampshire Agricultural Experiment Station with the purpose of ultimately developing a strain of trees with sap of high sugar content. This would be based on cuttings taken from a few exceptional trees producing sap with a sugar percentage considerably above the average. There is quite a lot of evidence that this type of performance is fairly consistent for certain trees. Thus, it may be to a considerable extent a genetic factor, although other factors such as site, etc., may have a bearing on the matter.

Early work on this project involved finding best methods of gathering and handling the cuttings, substances effective for root stimulations, etc. It soon became evident that moisture of the air around the foliage of cuttings was an important factor in keeping them alive; injury and death soon followed if the air was too dry. Beds of various types, including opaque chambers with fluorescent light, were tried as means of achieving high humidity of the air around the cuttings, but with indifferent success for the most part as regards rooting percentages of the total tested. It was only with a constant mist above the propagation beds that a fairly consistently sure method of rooting was evolved.

Experimental Results for 1951, '52, '53

A well drained ground bed in a greenhouse was used for most of the propagation work with constant mist. It was filled with sand and shaded with cloth and white wash on the roof above that. The nozzles were upright above the sand, placed at regular intervals. Various root-inducing chemicals were tried in comparison to untreated controls. These were applied by momentary dipping of the cut ends of the cuttings in a fairly concentrated solution in 50% alcohol, 0.1% to 1.0%. A summary of rooting results for the three years by treatments showed 22% rooting out of a possible 520 cuttings for the controls. Of the rest, indolbutyric acid (0.1% strength) gave about the best results, with 29% rooting out of 424 cuttings, although one other substance, p-chlorophenoxy-acetic acid, gave 32% rooted out of 32 cuttings.

A marked clonal difference in rooting was observed, i.e., percentage of rooting in cuttings from individual trees was quite different. Records kept on 4 old trees showed that this performance was fairly consistent from year to year. One tree producing sap of high sugar content had a low record of rooting. This tree was declining in vigor. Another tree, not quite so high in sugar percent of sap, but very vigorous, had a high rooting percentage in cuttings.

Records for a final test of the opaque chamber in 1951 confirmed previous records, that this is not as good a method as that of constant mist in open-air beds in a greenhouse.

Limited tests with an outdoor bed of cheap construction and with mist from oil-burner nozzles in 1953 indicated that this method is very promising. There was some indication that sawdust as a rooting medium has possibilities.

Throughout all of this work efforts by various means to carry the cuttings along after rooting and to prolong their life have been unsuccessful. Other methods that have been suggested look hopeful at this time.

CURRENT CANADIAN MAPLE RESEARCH PROBLEMS

by

Elphege Bois, Laval University, Quebec, Canada

A new maple spout. The all aluminum spout developed more than 5 years ago and marketed by L. Hoir, Levis, Quebec, has been redesigned by the Maple Products Division of the Quebec Department of Agriculture. The newly designed spouts offer the following advantages: (a) the trees can be tapped 15 days earlier, insuring the collection of the first sap run, which is desirable for quality sirup production, (b) because the spout tends to prevent "drying out" of the tap hole, it permits collection of the 3 last runs of the season not collected by the ordinary spouts used as controls. Since they permit early tapping during a period when there is less chance of contamination by adventitious organisms, the tap hole is essentially sterile and the new spout tends to keep it so.

Vertical maple sap evaporator. As a result of work begun in 1946 by Professor Cholette of the Engineering School of Laval University, a new type of evaporator has been developed which effects economies in both the fuel requirements and in the required floor space.

The new evaporator consists of a number of sections through which the hot flue gases pass vertically upward along 3" x 30" aluminum fins spaced 3/8" apart. The fins are brazed on aluminum sheets placed back to back one inch apart and closed on the bottom and ends to form the one-inch sap channels. The fins give 275 square feet of metal in contact with the hot flue gases for each 25 square feet of metal in contact with the sap.

The sap moves through the heating channels by convection currents. The sap is supplied from the reservoir mounted at the front of the flue box and is returned to it after passage upward through the sap channels. This causes a rapid movement of the sap, which prevents scorching due to local overheating. Various working models have been tried experimentally at the Plessisville Experimental Sugar Bush of the Quebec Department of Agriculture. The latest model tested in the Springs of 1952 and 1953 gave most encouraging results. That model occupied a floor space of 4'6" x 13' and had an evaporative capacity of 300 Imperial or 360 U. S. gallons per hour. To evaporate 700 Imperial gallons of water required one cord of wood. Further, the stack temperature was only 275°F. showing a good economy of heat. From the experiences gained from this model two new vertical evaporators are being built for operation during the 1954 season.

Automatic sirup draw off. To simplify the exacting task of drawing off sirup of standard density from an evaporator, a device has been developed which was tried out successfully in the Spring of 1952. The controller, a solenoid valve, is actuated by a thermostat energized by a 6 volt battery. The valve has two circuits, one for setting against boiling water to correct for barometric pressure, and the other for opening the valve at the temperature of the boiling standard density sirup. The controller is set by means of a first circuit, with the thermostat in boiling water. The thermostat is then adjusted for the boiling point of sirup. Switching to the other circuit causes the valve to open when contact is made by the thermostat.

One hundred of these devices were in use by Canadian producers last Spring; all reported excellent results.

The potassium content of maple products. Of all the minerals of maple sap and sirup those that have been studied are calcium, iron, manganese and lead. Knowing that potassium is the predominating soluble cation in the vegetable kingdom we thought that a study of the potassium content in maple sap and sirup would give us something new.

One hundred samples of sirup produced in Quebec were analyzed and found to have a potassium content ranging from 0.26% to 0.42%, with an average of 0.32%.

The analysis of maple products has at least three objectives: (a) to define the true product, (b) to detect adulteration, and (c) to find out the identity of the maple flavor. The sucrose (alpha glucopyranose 1-2 beta fructofuranose) is the same whether its source is sugar cane, beet or maple. We therefore can define true maple products only by substances which are present other than sucrose.

It is customary in the analysis of maple sirup to determine a wide variety of constants, such as conductance, soluble and insoluble ash, lead numbers, etc. Nearly all of these have such wide limits that they cannot be used to detect the addition of an adulterant except when it is added in large amounts. Dr. Cholette and Dr. Jean, both of Laval, have compared the limits of these constants by the mixtures rule, in which M is the highest proportion of the additive that cannot be detected by the usual constants. Application of these constants to the analysis of mixtures of pure maple and white or brown sugar is shown by the following equations:

Consider conductance values = I

Pure maple = I (max.) to I (min.)

White sugar, I white = zero

For white sugar-maple mixtures

$$1\ (I\ \text{max.}) + M\ (I\ \text{white}) = (1 + M)\ I\ \text{min.}$$

$$M = \frac{I\ \text{max.} - I\ \text{min.}}{I\ \text{min.} - I\ \text{white}}$$

$$= \frac{I\ \text{max.} - I\ \text{min.}}{I\ \text{min.}}$$

For brown sugar-maple mixture

$$1\ (I\ \text{min.}) + M\ (I(\text{brown})) = (1 + M)\ I\ \text{max.}$$

$$M = \frac{I\ \text{max.} - I\ \text{min.}}{I\ (\text{brown}) - I\ \text{max.}}$$

The mixtures rule can also be applied to mixture of 3 substances such as cane plus maple plus brown sugar. However, this rule cannot be used if a chemical reaction occurs between the additives and the substance being adulterated. According to this rule, the values most suitable for the detection of adulteration are the ones having the lowest M values.

Constituents of maple which meet these requirements are potassium as K_2O and phosphorus as P_2O_5. These constituents have the following ranges and M values:

	Pure Maple	M Values	
		Cane Sugar	Brown Sugar
K_2O	0.25 - 0.42%	0.68	0.80
P_2O_5	2 - 28 p.p.m.	--	0.25

Using these constants and the application of the mixtures rule it is possible to detect much smaller amounts of adulterants in maple sirup than was previously possible.

Discussion

Dr. Willits pointed out that Professor Bois' paper on the detection of adulteration of maple products was an outstanding contribution. This work is the first new approach to this difficult problem that has been made for a number of years. Because it appears to offer a workable means for the detection of adulteration, Professor Bois was urged to present this material to the Association of Official Agricultural Chemists for publication in their journal. It was also suggested that the proposed method be tested collaboratively by the Association so that it may be included in their forthcoming book of methods. It is hoped that this study can be started immediately so that the results may be reported at the Association's meeting in 1954.

The automatic draw-off described by Professor Bois was a subject of considerable interest.

In answer to questions regarding its operation as a continuous draw-off device, Professor Bois explained that it would handle finished sirup continuously providing the evaporator was of sufficient capacity to supply finished sirup to it continuously.

Other questions dealt with the rate at which it could handle sirup capacity and the location of the thermostat. Professor Bois showed that the drain tube in the model on display was 1/4" I. D. This he explained was adequate to take care of the sirup produced by the large size evaporators. The thermostat, like the thermometer, has to be positioned in the boiling sirup as close as possible to the point of sirup draw-off.

The conferees were also interested in the newly designed vertical evaporator and asked a number of questions regarding its construction. All expressed great interest in it and stated that they would be anxious to learn of the results that are to be obtained with the redesigned evaporator during the 1954 season.

SOME OBSERVATIONS ON THE NATURE OF COLOR AND FLAVOR OF MAPLE SIRUP

by

William L. Porter, Eastern Regional Research Laboratory

In June of last year I talked at the American Chemical Society's Analytical Symposium on the subject of ion-exchange and chromatographic analyses as applied to the study of flavor and color of maple. One sentence was devoted to tell that "up to date we have not been able to identify the flavor or flavor constituents, but we have been able to gain considerable knowledge on what causes both color and flavor and to some extent how they may be controlled." The national news agencies sent out releases on the talk which were quite authentic, and newspapers from East to West carried little news items on it. However, one paper had an editorial which I believe tops them all. I want to read it to you, not with the idea of making fun of the editor or to argue with the romance associated with maple sirup making, but to lead up to the reasons upon which our thinking and, therefore, our studies are based. Here is the editorial from the Brattleboro Phoenix:

"Maple Syrup Baffles Scientists

Out in Michigan last week, the American Chemical Society's analytical symposium heard two doctors admit they were being driven nuts trying to find out what makes maple syrup taste like maple syrup. We feel sorry for them, as we are for all baffled people - which includes just about all of us members of the human race. But it does seem as though there is a big enough supply of bafflement in the field of human relations without a couple of scientists having to go snooping around maple trees to get themselves a special kind of frustration.

And they might just as well quit bothering the maple trees - and syrup producers - right now, because even though they have 'divided the sap and the syrup into three components and subdivided those even further' they aren't going to discover what makes maple syrup taste like maple syrup - not Vermont's, anyhow.

All one has to do in order to realize that the flavor of Vermont maple syrup never will yield up its secrets to any laboratory test tubes is to look at the Vermont countryside on days such as we have been having. Those flaming reds, oranges and yellows soaking up the special kind of air we have here in Vermont belong to trees that may talk to poets, philosophers or just plain scribblers - but never to scientists gathered in analytical symposia.

Furthermore, Vermont's maple trees don't draw their unique sap just from the air and soil of this state; they draw some of it from the history, drama and exhilarating peculiarities of people, young and old, known as Vermonters. No other state in the union can take a mixture of ornery, stubborn and frugal characters and extract from that mixture a state product so bountiful in its sweetness as is pure Vermont maple syrup. Try measuring that in a test tube, gentlemen.

Strangely enough - since we are no scientists - we found ourselves wondering last Sunday morning just what made our maple syrup taste so good. And as we looked at the old maple trees shedding their autumn colors preparatory to riding out the winter unencumbered, we remembered those spring days when the same trees were yielding up their special juices, and how the mixture of wood smoke and boiling sap permeated our entire being with a new look at life after a long winter. We sat there Sunday with our memories adding their bit to the way our syrup tasted.

And that's one of the reasons the scientists will fail and will continue to be baffled. Along with many other things which are ingredients of the taste of Vermont maple syrup are memories, and memories are allergic to test tubes.

There's only one answer to this problem, gentlemen of the American Chemical Society, and that is to adjourn to the coffee shop and make sure it is 'pure Vermont maple syrup' you ask for.

Don't try to analyze it; just enjoy it."

J.S.H.

I'm sure the writer of this tid-bit of American literature did not mean that we should stop work on the identity of maple flavor and color. Actually, we don't really care to know except from an academic standpoint and to satisfy a natural curiosity, but only want to know how to control these two factors in maple and thereby produce better and more consistent products and to produce concentrates for use in flavoring other foods.

You have heard us and others tell of the fact that maple sap, wherever it comes from, does not contain maple flavor. This can be demonstrated by freeze-drying sterile maple sap to obtain a white solid devoid of maple flavor. Resolution and heating at atmospheric temperature produces both flavor and color. This development of flavor occurs because the sap contains precursors which, under the influence of the boiling temperature, are caused to react to form one or more new materials having color and flavor. This is not a new type of reaction, since many food products are known to produce both good and bad flavors under similar conditions. For example, dried milk powder develops color and off-flavors during storage, and coconut does the same thing. The flavor of coffee and peanuts is developed during the roasting process. This reaction is known to chemists as the browning reaction, or sometimes as the Maillard reaction, after the man who first reported it. It is usually thought to be the result of the reaction between amino acids (the building stones for proteins) and reducing sugars such as glucose found in corn sirup. However, it is now recognized that peptides and organic acids can also play a part in the reaction.

When you think of flavor developing through a reaction of this type, it comes to mind that it is a general reaction common to most foods. If this is true, why is it that of all the plant and animal life found in nature, only the maple produces a sirup having the characteristic flavor? Well, it means that maple sap must have one or more compounds which are peculiar to maple. In order to solve the flavor identity problem these compounds must be isolated and identified. This, of course, is the approach we are taking.

Just a little more about the browning reaction. Temperature, pH, the presence or absence of oxygen and moisture content, all play a role in the rate and amount of reaction. Each of these factors must be controlled in any study of this kind.

If maple sirups are heated at high temperature (up to 250°F.) and low water content (as in the high-flavoring process) the color and flavor appear to go hand in hand up to the point where the caramel flavor completely overshadows the more delicate maple flavor. If we determine the extent of color development by means of a spectrophotometer we can calculate the dilution with colorless and flavorless cane sirup necessary to obtain a blended product having the same flavor intensity as the starting material.

Since this is true, there must be some direct or indirect connection between the two reactions. We have been able to show that sterile sap evaporated to sirup as rapidly as possible in a steam kettle produces an exceedingly light product with an extremely delicate flavor difficult to recognize as maple. Non-sterile sap produces, under the same conditions, a darker product with more flavor. We have also been able to show that maple sap as it emerges from the tree contains no reducing sugars and that there is little increase during the evaporation. Non-sterile sap does contain reducing sugars, and more are formed during the evaporative process. These and other data lead us to the belief that the relationship between color and flavor is through the reducing sugars.

Some years ago, two chemists at Johns Hopkins University showed that reducing sugars are broken down by alkali to give sugar fragments having three carbon atoms, which is just one-half that of the reducing sugar molecule. These fragments are very reactive and usually are not stable. Also each one is different and produces different compounds upon reaction with water. Since they are different, it is possible that one could go in one direction and the second in another to form two different types of compounds of radically different properties, such as maple flavor and the coloring matter of maple sirup.

In order for this to occur in maple sap two conditions would be necessary: (1) the presence of simple reducing sugars and (2) an alkaline medium. The reducing sugars usually take care of themselves either from microbial contamination, high temperatures of boiling, or both. Snell, Bois and Hayward have shown that maple sap undergoes a pH change from slightly acid to alkaline and back to slightly acid during the evaporation to sirup. We have confirmed these observations. The alkalinity is due to breakdown of carbonates and bicarbonates with a loss of carbon dioxide. Some of the sugar fragments are changed to organic acids which slowly neutralize the alkalinity, and we end up with a strongly buffered sirup. Now what does this mean in terms of color and flavor? We are only guessing at this time, but it looks as though the initial alkalinity produces from each reducing sugar molecule two three-carbon fragments which are very reactive. As the reaction continues, organic acids are produced from some of these fragments which slowly neutralize the alkalinity. At the same time, amino acids, peptides or organic acids react with one of these fragments to produce flavor bodies, and with another to form color bodies. Since the two fragments are present in equal amounts, the quantities of the new materials produced are about equal. At the present time, much of our effort is toward the study of these reactions in maple sap.

Another observation which may be important to your thinking is that in many food products, especially in milk powder, the browning reaction proceeds at its greatest rate at 10% moisture content, with the rate falling off above and below this value. When we remove water from maple sirup so that the boiling point is raised to 252°F. we have lowered the moisture content to about 10%, as near as we can calculate, and it is at this point that we get the greatest rate of flavor production. This again points to a browning reaction.

As far as we can tell at present, the flavor is not caused by a single constituent but is probably a group of flavors which together give the sensation of maple. Solvent fractionation as well as ion-exchange techniques lead us to this idea.

In conclusion, we can say that our newspaper editor is still correct when he says we are baffled as to the identity of the flavor constituents of maple. However, we are gaining knowledge of the mechanism of the formation of the materials, which we can and already have applied to maple production. Who knows but that we might try mixing in some autumn foliage, some history, drama, romance, some peculiarities of people from all the maple states, plus some more chemical and physical know-how, and come up with the answer. Professor Bois showed many of us one of his preparations from maple bark. However, I'm sure that the greatest advance will come from the chemical and physical information. At least for the present we will stick with them.

THE ORGANISMS OF MAPLE SAP: THEIR EFFECT AND CONTROL

by
J. Naghski, Eastern Regional Research Laboratory

(Summary)

Sterilizing effect of sunlight. It is a well established fact that growth of microorganisms in maple sap affects adversely the color, flavor and quality of the maple sirup made from it. Except for exercising scrupulous cleanliness and rapidity of handling of the sap, both of which are difficult to attain in the sugar bush, no method had been proposed which could effectively control microbial deterioration of maple sap through the season. Thus it is the common experience that maple products produced in the latter part of the season are usually of lower quality. Recently, plastic bags have been introduced as a substitute for metal or wood buckets for hanging on the tree to collect sap. Studies at the Laboratory [(1)] have shown that these bags are transparent to the sun's ultraviolet rays in the region near 300 millimicrons and will keep sap essentially sterile. Collection of sap in such bags not only keeps the sap in a sterile condition but also sterilizes sap that has become contaminated through microbial growth in the taphole or spout. The sterilizing effect was most pronounced on cool, sunny days, but was also operative on cloudy days. Evidence was obtained that in the exposed bags the growth and destruction of microorganisms occurs simultaneously and that the predominance of one process over the other is dependent on such factors as temperature, intensity of radiation and time of exposure. This is the first time that a means has been demonstrated to provide a continuous supply of sound sap throughout the season for evaporation to sirup.

Microorganisms of maple sap. To determine the types of organisms that are normal to the various sirup producing areas and to build up a culture collection, sterile sample bottles were distributed to producers in New York, Ohio, Pennsylvania and Wisconsin. We wish to acknowledge the assistance of Professors Winch and Trenk in distributing these bottles. The producer was asked to fill the bottle with spoiled sap and send it to the Laboratory. Of the 62 bottles that were distributed, 34 (or 55%) were returned. The cooperation of the producers was most gratifying. A breakdown of these results showed that New York producers returned 26 out of 35 bottles (or 74%); Wisconsin producers returned 6 out of 15 (or 40%); Ohio producers returned 2 out of 6 (or 33%) while none was returned from Pennsylvania.

From these samples, over 500 cultures were isolated, including bacteria, yeasts and molds. Bacteria were the predominating spoilage organism, although a few samples contained yeasts. This may be a reflection of the sudden ending of the sap season in all the areas during the last year. Previous workers have observed a preponderance of yeasts which are favored by the warmer weather at the end of the season.

Studies have shown that some of these bacteria are capable of growing at low temperatures. A measurement of the rate of growth showed that one of these organisms had a generation time of six hours at 33-37°F. and four hours at 41-44°F.

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(1) J. Naghski and C. O. Willits. Maple Sirup VI. The sterilizing effect of sunlight on maple sap collected in a transparent plastic bag. Food Technology 7, 81-83 (1953).

Collection of sterile sap. In order to be able to study the effect of the growth of individual organisms on the quality of maple sirup, it was necessary to have a supply of sound sap. Sterile maple sap was obtained by using aseptic tapping and collecting methods similar to those reported by Holgate (New York State Agricultural Experiment Station Bulletin 742, 1950). Bits, 7/16 inches in diameter, were wrapped in paper and sterilized in the autoclave. The spout apparatus consisted of a rubber stopper, for a 5-gallon bottle, which had an inverted glass U-tube plugged with cotton (firmly but not tight) to equalize air pressure, and a piece of straight glass tubing which was connected to a spile by a short length of rubber tubing. The spile (closed type) was fitted in the rubber tubing, and this assembly was also wrapped in paper and sterilized in the autoclave. The bottle was plugged with cotton and sterilized in a similar manner.

In attaching the apparatus to the tree, a smooth section of the tree was selected and a thin layer of outer bark removed with a wood chisel for about four square inches around the site selected. The area was then saturated with alcohol and ignited. While still burning, a 7/16-inch hole was drilled with the sterile bit and the spile inserted as rapidly as possible. The tree end of the spile was poked through the paper and hammered into place by means of pounding on a screw driver held against the shoulder of the spile. The cotton was then removed from the bottle and the rest of the paper from the spile assembly, whereupon the rubber stopper was quickly inserted in the bottle. Sterile technique and precautions were used throughout, and in this manner it was possible to collect essentially sterile sap during the entire season. The sap was stored in the frozen state for use during the rest of the year.

Effect of microorganisms on color of maple sirup. Five different cultures, including three types of bacteria and two types of yeasts, were investigated for their effect on color of maple sirup. Sterile sap was inoculated with the desired microorganisms, and these were allowed to grow at 33-37°F. for different periods of time. A laboratory method was developed using steam kettles whereby as little as two gallons of sap could be evaporated to sirup under carefully controlled and reproducible conditions. It was found that the growth of some of the bacteria in maple sap resulted in production of a dark-colored sirup, while the growth of others did not influence the color of the sirup appreciably. The two yeasts included in this study also were without effect on color. These results are in keeping with the proposed theories that color and flavor are the result of a chemical reaction of constituents in the sap. Undoubtedly the bacteria, by fermenting the sap, produce new compounds from the sugars, organic acids and the nitrogenous components which enter into the color forming reaction.

Oxygen utilization by bacteria growing in sap. During studies on the changes that bacteria produce in maple sap it was observed that oxygen utilization could be correlated with bacterial growth. Dissolved oxygen in the sap was measured polarographically. Determinations of oxygen utilization showed the rate not only increased with temperature but was directly proportional to the rise in temperature. The response of bacteria to a rise in temperature was instantaneous and without the expected lag, as indicated by the sudden and practically instantaneous increase in the rate of oxygen utilization as the temperature was increased. The rate of oxygen utilization was also found to be proportional to the bacterial population in the sap.

Role of bacteria in premature drying of the taphole. During the past season, evidence was obtained which indicates that bacteria and possibly other microorganisms are responsible for the premature drying of the taphole. Frequent culturing of the sap issuing from the spiles showed that once bacteria appeared their numbers increased rapidly, and the sap obtained from spiles that had practically stopped running contained in the order of 100,000,000 bacteria per c.c. One such taphole was reamed and the reamings cultured. These showed a bacterial content of 210,000,000 per gram.

These results indicate that sap spoilage is not limited to buckets, gathering tanks or storage tanks but can also occur in the taphole. It is also evident that development of means for eliminating or controlling taphole infection would result in better quality sap and sirup and prevent premature drying of the tapholes.

Discussion

(While the discussions following papers have in general been omitted, the comments and discussions on this paper are included, since a number of important points were brought out.)

Comment by Dr. Porter: The work that Dr. Naghski has initiated will lead to a new approach to the problem of maple sirup composition. We will have to consider what happens after fermentation to the various constituents, such as sugars, organic acids, and nitrogen compounds.

Comment by Professor Bois: The problems in the microbiology of maple sap may be similar to those encountered in the spoilage of fish. It was the common experience that different organisms were isolated at different times, and it was only after the bacteria were considered as enzyme systems that the problem was simplified. It may be that if the microorganisms associated with the deterioration of maple sap are considered as enzyme systems rather than individual strains this problem will also be simplified. For even in the plastic bags there is some growth during the first and second day before the organisms are killed, and even if there is no further growth the enzymes are already present and may continue to act.

Question: I understand that certain metals, especially silver, have a bactericidal effect. Could it not be possible to silverplate the spiles?

Answer: The bactericidal property of metals was first investigated some forty years ago and has been of considerable academic interest. However, the effect is of a slight magnitude and of little practical value.

Question: Have you ever made sirup from sterile sap?

Answer: Yes. The sirup was very light in color and had a mild, delicate flavor.

Question: Is there anything peculiar to the organisms producing the large amounts of color in the sirup?

Answer: These bacteria belong to the class known as proteolytic organisms. They preferentially attack nitrogenous compounds and will hydrolyze protein as polypeptides to amino acids and even liberate free ammonia. The other organisms which did not influence the color to any extent are known as saccharolytics, and preferentially ferment the sugars.

Question: Do any bacteria have any effect on the sugar sand?

Answer: We have isolated a bacterium that preferentially attacks the malic acid, so that sugar sand (calcium malate) will not form. Unfortunately, this bacterium also produces off-flavors and so is not useful in sirup production.

Question: By the end of the season, sirup pans accumulate large deposits of sugar sand. Is there any way to prevent it or remove it easily?

Answer: The general consensus of the producers volunteering answers was that the pans should be cleaned after every batch. Hydrochloric (or muriatic) acid should not be used, or it should be used very carefully as it may damage the pans. Flooding the pans with water after the sirup has been drawn off and letting them soak will remove most of the sugar sand. One producer lets spring water run through the pans when not in use and finds that the sugar sand dissolves away. One producer reported satisfactory results using a commercial cleaner for milk equipment called "Dilac".

Question: Would the use of sterilamps over sap storage tanks be feasible?

Answer: In order for the lamps to be effective the rays would have to penetrate the liquid, which would probably be too deep in a storage tank unless it were circulated continuously so as to be exposed near the surface. A more effective method would be to have the sap flow in a film around the lamp, as is used for water sterilization.

Question: Is buddy sap the same as fermented sap?

Answer: Some think that buddy sap and fermented sap are the same, but the true buddy sap has a distinctive flavor that is different from fermented sap. This can be shown by using sterile tapping techniques and collecting sap without any bacteria after the season has ended. In a normal season under ordinary tapping conditions when sap becomes contaminated with microorganisms, the usual off-flavor encountered is that of fermented sap and not due to the buddy condition of the tree.

Question: If ultraviolet rays will keep the sirup sterile on top, would it be possible to draw off the top layer and sterilize it with sterilamps?

Answer: Yes.

Question: Mr. Holbert, aren't you using sterilamps for preserving sirup?

Answer: Yes, we use outdoor storage tanks and have installed sterilamps in the manholes at the top and have had no trouble from spoilage.

Question: Can you tell approximately at what bacterial content does sap appear milky?

Answer: The point at which sap appears milky depends on thickness of the layer one is viewing. For a layer about 1-1/2 inches thick and viewed against daylight, sap will appear milky when the bacterial content is about one million per c.c.

REPORT OF THE INFORMAL MAPLE ADVISORY COMMITTEE

by

Clyde N. Smith, Chairman

Mr. Smith reported that the Committee had met informally on November 16, and it was the opinion of the group that they should listen to the remainder of the program and meet again at the end of the conference to assemble some suggestions that they might have to send in by mail. Dr. Wells indicated that the Laboratory wanted to know what the maple industry considered the most important problems.

Mr. Smith pointed out that at the time of the previous maple conference (November, 1950) a group of industry representatives had met with the idea of forming an informal industry advisory committee. This group met again in June 1951, at which time it recommended to the industry the formation of a National Maple Association.

Mr. Holbert suggested the committee meet at the conclusion of the conference to consider problems. The minutes of the meeting, held at 4:10 p.m. on November 18, follow:

Mr. Smith, in opening the meeting, said that the Committee had heard the various research reports during the Maple Conference and could now take whatever actions were appropriate.

A motion was made jointly by Mr. Holbert and Mr. Rees that the Committee approve and recommend the continuation of ERRL research on microorganisms, evaporator design, the high-flavor process, fundamental reactions of flavor and color development and other research activities of benefit to the maple industry. The motion was seconded by Mr. Robbins and carried unanimously.

There was a discussion of scheduling conferences on maple products, following which Mr. Soule moved that the Committee approve and recommend the continuation of the policy of the ERRL to hold conferences on maple at such times as seem appropriate to the Laboratory. Mr. Simonds seconded, and the motion was carried unanimously.

There was a discussion of RMA contracts, following which Mr. Rees moved that the Committee approve present work under RMA contract and recommend the

extension of such work where it appears desirable. Mr. Johnson seconded, and the motion was carried unanimously.

There was next a discussion of membership on the Committee. Mr. Smith emphasized that he had sought to have representation on the Committee from all segments of the industry and that, so far as he knew, no segment was unrepresented. It was brought out that the Committee setup envisions a member representing each of the following:

(a) Equipment manufacturers
(b) Blenders
(c) Packers
(d) Producers from each of the major maple-producing states.

Mr. Smith also reviewed the meeting of Advisory Committee members recommending formation of a Maple Industry Association, on June 11-12, 1951, and distributed copies of a resolution adopted by the Committee at that time.

It was agreed that since the organization is intended to present the views of the maple industry, representatives of governmental agencies are not qualified to membership.

It was agreed that a subsequent meeting of the Association could be called by the chairman at any time, and Mr. Smith said he would call a meeting upon request.

Mr. Rees next moved that the Committee suggest that the Laboratory give all possible impetus to work on the detection of adulteration, since new methods for determining adulteration are desirable. Mr. White seconded, and the motion was carried unanimously.

The meeting adjourned at 4:45 p.m.

The following were present:

Name	Organization	Address
Clyde N. Smith, Chairman	Vermont Maple Sugar Makers Association, Incorporated	Burlington, Vt.
S. A. Holbert	Holbert Bros.	Onamia, Minn.
Charles Hubbell	--	Jefferson, N.Y.
Frank L. Jenne	American Maple Products, Inc.	Newport, Vt.
Ture L. Johnson (alternate for Tom White)	Ohio Department of Natural Resources	Burton, Ohio
Clement A. Lyon (alternate for Paul B. Gay)	New Hampshire Maple Producers Association	Concord, N. H.
Frank M. Rees	United Maple Products, Inc.	Burlington, Vt.

Name	Organization	Address
Adin Reynolds (alternate for D.V.Nusbaum)	--	Aniwa, Wis.
P. W. Robbins	Michigan State College	East Lansing, Mich.
W. W. Simonds (alternate for J.E.Lepley)	Penna. State University	State College, Pa.
E. I. Soule (alternate for R.C.Soule)	George H. Soule Co.	St. Albans, Vt.
W. E. White (alternate for J.E.Lepley)	Penna. State University	State College, Pa.
W. P. Ratchford, Secretary	Eastern Regional Research Lab.	Philadelphia 18,Pa.

FLAVOR EVALUATION OF MAPLE SIRUPS

conducted by
C. O. Willits, J. Naghski, A. P. Hoban, and W. L. Porter
Eastern Regional Research Laboratory

(Report of the Results of the Taste Testing of Maple Sirups Made During the Conference)

In an attempt to find a maple sirup having a flavor which could be accepted as a standard in our research work on maple products, a taste test was conducted at this maple conference. We believed that to conduct such a test with judges who are experts in the maple field would provide us not only with the answer to our problem but would yield other interesting information.

The samples of sirups were procured from different sources and localities. In each case the suppliers were requested to send a sirup which in their opinion was tops in maple flavor, irrespective of its color. The test was set up following the paired scoring procedure outlined in the 1950 maple conference proceedings. Briefly this consists of judging pairs of samples, the judges indicating either a preference for one of the pairs or no preference. Each pair was judged independently and then these preferences for all the samples were compiled. A plus (+) mark was given the sample which was distinguishably better than the other sample of a pair, and a half mark for both samples of the pair if their flavors were identical. The score is based entirely upon preference. After all pairs have been judged, they are scored as follows: assume that 4 sirups--q, x, y and z-- are to be judged and that q is better flavored than x, x better than y, and that y and z are equal.

Score of Maple Taste Test

Samples pairs		q	x	y	z
		Preferences			
q	x	+			
q	y	+			
q	z	+			
x	y		+		
x	z		+		
y	z			1/2	1/2
Totals or score		3	2	1/2	1/2

In this type of judgment the score for each sample is the total obtained by addition of the preferences.

The samples were dispensed from opaque containers and tasted from red spoons so as to obscure the color of the sirup as much as possible and to prevent the color biasing the judgment.

Description of the samples used in the test was as follows:

Code	Source	Grade	Color Index*
A	New York	U. S., A N. Y., No. 1 Vt., A	0.78
B	Ohio	U. S., AA N. Y., Fancy Vt., Fancy	0.36
C	Minnesota	U. S., B N. Y., No. 2 Vt., B	1.13
D	Vermont	U. S., B N. Y., No. 2 Vt., B	1.19
E	Vermont	U. S., AA N. Y., Fancy Vt., Fancy	0.48

* The color index ranges for the different U. S. grades of maple sirup are: Grade AA, 0-0.50; Grade A, 0.51-.90; Grade B, .91-1.47.

Fifty of the conferees participated in the judgments; of these, 46 judged at least 3 of the 5 groups of pairs, and 28 judged all pairs.

The preferences and scores for the 5 samples have been treated as shown in Tables 1 and 2. In Table 1 the preferences indicated by all of the judges for the 5 samples of the 10 sample pairs have been compiled, and the total number of preferences or score for each sample is shown. In Table 2, the scores of the 5 samples have been summarized and broken down into a number of categories.

Table 1

Preferences by All Judges for the Five Samples by Pairs

Samples		A	B	C	D	E	No. of Judgments
		Total Preferences					
A	B	24	21				45
C	D			35.5	9.5		45
A	C	27		19			46
B	D		27.5		18.5		46
A	D	31.5			12.5		44
B	E		19			25	44
B	C		32	13			45
A	E	23.5				21.5	45
D	E				16	28	44
C	E			12		32	44
Total or Score		106	99.5	79.5	56.5	106.5	

Table 2

Summary of Scores

Samples	A	B	C	D	E	No. of Judgments
All judgments	106	99.5	79.5	56.5	106.5	50
Complete sets of judgments	68.5	64	45.5	33	69	28
Incomplete sets of judgments	37.5	35.5	34	23.5	37.5	22
Producers	37	35	21	8	33	15
Processors	19.5	20	12.5	12	16.5	9
Canada	16	22.5	11.5	7.5	16.5	8
Massachusetts	4	0	3	1	2	1
Michigan	1	3	3	0	3	1
Minnesota	3	0.5	1	2	1.5	1
New York	35.5	31	16	0.5	28	12
Ohio	5.5	6	3.5	0	5	2
Pennsylvania	11.5	8	5	1.5	16	5
Vermont	11.5	12	7	10	11.5	6
Wisconsin	5.5	7	8	7.5	8	4
Inexperienced *	12.5	10.5	21.5	26.5	15	10

* Includes all judges who have not had an extended association with maple products.

Summaries and analyses by breakdown of the data have been made to show the distribution of the scores as influenced by such factors as sectionalism and acquaintance with production or processing of maple products. To make these comparisons easier, Table 3 presents the data after it was weighted to take into consideration differences in number of judgments for the different pairs. The weighting factor used was equal to the maximum number of judgments (46) divided by the number of judgments for the particular group under consideration.

Table 3

Summary of Weighted Scores

Samples	A	B	C	D	E	Factor
All judgments	110.5	98.4	81.1	58	112	multiple
Complete sets of judgments	112.5	105.1	74.7	54.2	113.4	46/28
Incomplete sets of judgments	95.8	90.7	86.9	60.1	95.8	46/18
Producers	113.5	107.3	64.4	24.5	101.2	46/15
Processors	99.7	102.2	63.9	61.3	84.3	46/9
Canada	92	129.4	66.1	43.1	94.9	46/8
New York	136.1	118.8	61.3	1.9	107.3	46/12
Pennsylvania	105.8	73.6	46	13.8	147.2	46/5
Vermont	88.2	92	53.7	76.7	88.2	46/6
Wisconsin	63.3	80.5	92	86.3	92.0	46/4
Inexperienced	57.5	48.3	98.9	121.9	69	46/10

The number of judgments from Massachusetts, Michigan, Minnesota, and Ohio were insufficient for weighting to be significant.

Significance of Data

1. The scores of the 28 complete sets of judgments were quite similar to the scores obtained from the total of all judgments and to the score of the incomplete sets of judgments.

2. In nearly all cases the first choice was divided between samples A (No. 1), B (Fancy) and E (Fancy), with the exception of the group of judges designated as having limited association with maple. This group gave samples C and D (No. 2) the higher scores.

3. These scores do not show any strong sectional preference for any one of the three grades of sirup.

4. With the exception of the scoring of sample D, the similarity of the scores of the producers and processors is of special interest.

5. The fact that sample A, which is of U. S., A (N. Y. No. 1) grade, ranks equal with samples B and E, U. S., AA (Fancy) grade, indicates that an excellent flavor can be developed in sirups other than those having a light amber color (U. S. AA or Fancy grade). However, these light amber colored sirups were consistently given the highest scores.

6. These judgments have clearly indicated that samples A (U. S., grade A), B (U. S. grade AA) or E (U. S., grade AA) have flavors that are acceptable for use as standards.

The authors express their appreciation to members of the 1953 maple conference for their cooperation and enthusiastic participation which made these tests a success, and to R. A. Bell and E. K. Chatterton for their technical assistance.

LIST OF ATTENDANCE

Name	Organization	Address
Adams, Mrs. Reed	Smada Farms	Greene, N. Y.
Anderson, Kenneth E.	Production and Marketing Administration, U.S.D.A.	Washington, D. C.
Ayres, Col. Fairfax	Fayrport Farm	Shaftsbury, Vt.
Barraclough, K. E.	University of New Hampshire	Durham, N. H.
Bell, R. A.	Eastern Regional Research Lab.	Philadelphia, Pa.
Benjamin, Murray	Central New York Maple Producers Association	Burlington Flats, N.Y.
Boggess, Charles S.	American Tobacco Company	Richmond, Va.
Bois, Elphege	Laval University	Quebec, Canada
Bostwick, Elmer P.	Production and Marketing Administration, U.S.D.A.	Washington, D. C.
Boylan, Edward R.	Cary Maple Sugar Co., Inc.	New York, N. Y.
Brice, B. A.	Eastern Regional Research Lab.	Philadelphia, Pa.
Bowen, W. A.	The John G. Paton Company	New York, N. Y.
Case, William H.	Chicago Quartermaster Depot, U. S. Army	Chicago, Ill.
Churchill, William	Central New York Maple Producers Association	Jefferson, N. Y.
Conklin, Hugh R.	General Foods Corporation	Hoboken, N. J.
Conlin, Augustus	American Maple Products, Inc.	Newport, Vt.
Cunningham, F. E.	Northeastern Forest Experiment Station	Upper Darby, Pa.
Delisle, Roch	Department of Lands and Forests	Quebec City, Canada
Deschenes, S. M.	Department of Agriculture	Montreal, Canada
Dunn, S. J.	University of New Hampshire	Durham, N. H.
Dymond, Robert	Maple Hill Farms	Prattsville, N. Y.
Eskew, R. K.	Eastern Regional Research Lab.	Philadelphia, Pa.
Farrend, E. P.	Pennsylvania State University	State College, Pa.
Greene, Miss Mary T.	University of Vermont	Burlington, Vt.
Haas, Charles A.	Agricultural Extension Service	Columbus, Ohio
Hayes, Kirby M.	University of Massachusetts	Amherst, Mass.
Henderson, H. E.		Oshkosh, Wisconsin
Hoban, Miss A. P.	Eastern Regional Research Lab.	Philadelphia, Pa.
Holbert, S. A.	Holbert Brothers	Onamia, Minn.
Homiller, R. P.	Eastern Regional Research Lab.	Philadelphia, Pa.
Hubbell, Chas. R.		Jefferson, N. Y.
Hudson, Victor J.	General Foods Corporation	New York, N. Y.
Huntley, Earl	Central New York Maple Producers	South Otselic, N. Y.
Jenne, Frank L.	American Maple Products, Inc.	Newport, Vt.
Johnson, Ture L.	Ohio Dept. of Natural Resources	Burton, Ohio

Name	Organization	Address
Knock, D. B.	Penick & Ford Ltd., Inc.	New York, N. Y.
Kribben, B. D.	Boweys, Inc.	Chicago, Ill.
Kriebel, Howard	Agricultural Experiment Station	Wooster, Ohio
Landry, C. E.	Les Producteurs de Sucre D'Erable	Quebec, Canada
LeClerg, Erwin L.	Agricultural Research Administration, U.S.D.A.	Washington, D. C.
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Marvin, James W.	University of Vermont	Burlington, Vt.
Moroney, R. H.	Vermont Evaporator Company	Ogdensburg, N. Y.
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Morrow, Robt. R., Jr.	New York State College of Agriculture	Ithaca, N. Y.
McLallen, Gerald		Cambridge Springs, Pa.
Naghski, J.	Eastern Regional Research Lab.	Philadelphia, Pa.
Patten, Howard L.	Maple Producers Cooperative Association	Lawrenceville, N. Y.
Phillips, G. W. M.	Eastern Regional Research Lab.	Philadelphia, Pa.
Porter, W. L.	Eastern Regional Research Lab.	Philadelphia, Pa.
Prefontaine, R.	United Maple Products, Ltd.	Granby, Quebec, Canada
Ratchford, W. P.	Eastern Regional Research Lab.	Philadelphia, Pa.
Rees, Frank	United Maple Products, Inc.	Burlington, Vt.
Reynolds, Adin		Aniwa, Wisconsin
Robbins, P. W.	Michigan State College	East Lansing, Mich.
Roberge, Armand	Maple Cooperative	Plessisville, Quebec, Canada
Schreiner, Ernest J.	Northeastern Forest Experiment Station	Upper Darby, Pa.
Simonds, W. W.	Pennsylvania State University	State College, Pa.
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Sipple, L. H.	Central New York Maple Producers	Bainbridge, N. Y.
Smith, A. Leroy	Vermont Maple Sugar Makers Association, Inc.	Barre, Vt.
Smith, Clyde N.	Vermont Maple Sugar Makers Association, Inc.	Burlington, Vt.
Smith, X. K.		South Dayton, N. Y.
Soule, E. I.	George H. Soule Company	St. Albans, Vt.
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Trenk, F. B.	University of Wisconsin	Madison, Wisconsin

Name	Organization	Address
Vallieres, Georges	Department of Agriculture	Quebec, Canada
Wells, P. A.	Eastern Regional Research Laboratory	Philadelphia, Pa.
Wendt, A. S.	Fred Fear and Co.	Brooklyn, N. Y.
White, W. E.	Pennsylvania State University	State College, Pa.
Willaman, J. J.	Eastern Regional Research Laboratory	Philadelphia, Pa.
Williams, W. K.	Extension Service, U.S.D.A.	Washington, D. C.
Willits, C. O.	Eastern Regional Research Laboratory	Philadelphia, Pa.
Winch, Fred, Jr.	Cornell University	Ithaca, N. Y.
Wright, L. E.	Western New York Maple Producers Ass'n.	Johnsonburg, N.Y.